# Electrical World

APRIL 5, 1941

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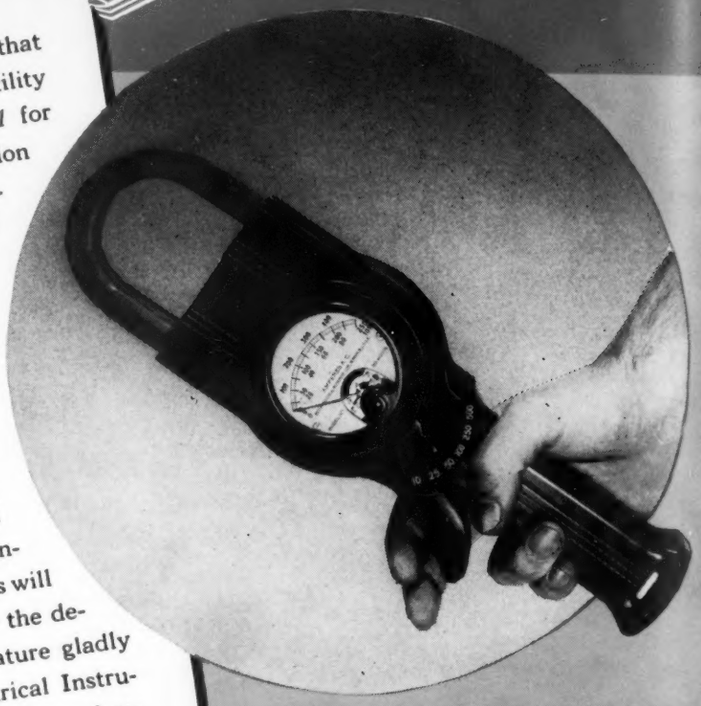

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April 5, 1941

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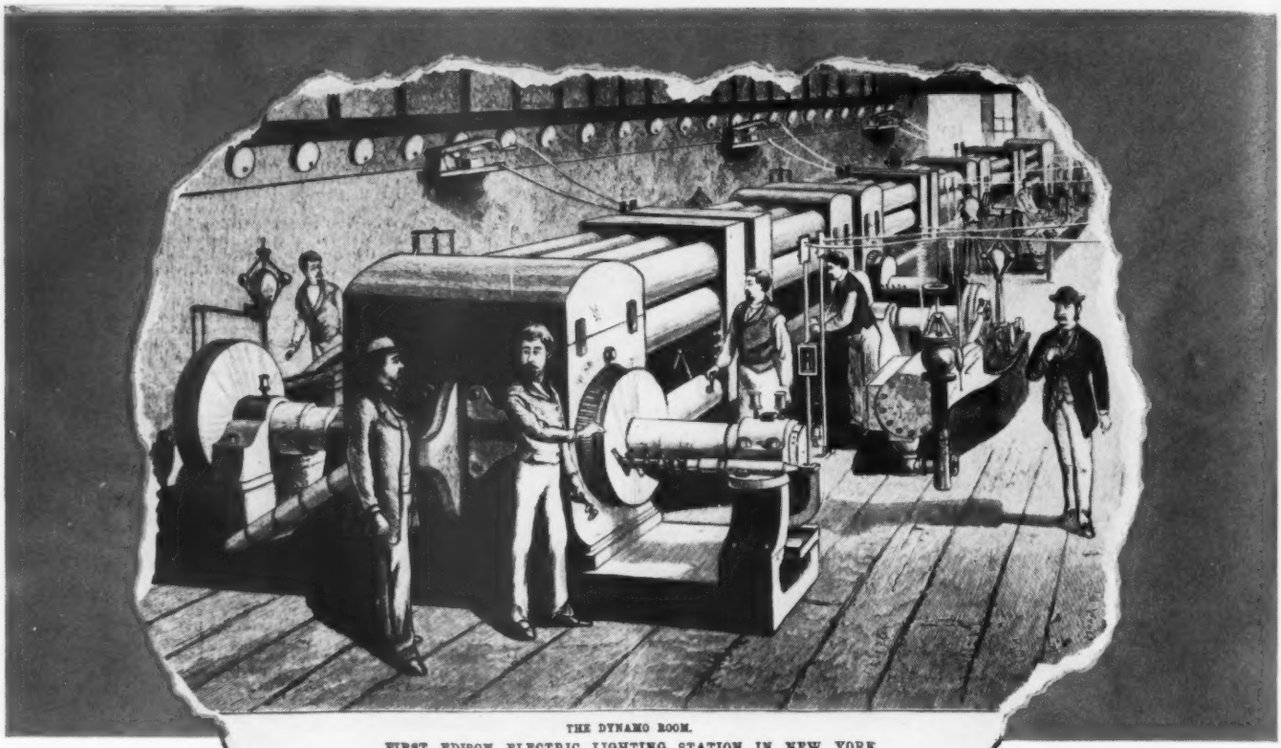

THE DYNAMO ROOM.
FIRST EDISON ELECTRIC LIGHTING STATION IN NEW YORK.

# When Edison Built The Pearl Street Station

## Electrical Men Relied On

# OKONITE

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In 1941 the parade of progress of the Electrical Industry finds Okonite still in the forefront with wires and cables of such outstanding characteristics that today's users still rely on Okonite for long, uninterrupted performance under the severest conditions.

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2. The Okonite formula is proved by long use rather than accelerated tests
3. Conductors perfectly centered by the Okonite strip-insulating process
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5. Thoroughly tested and inspected throughout the manufacturing process

Okonite's Okoloy coating on conductors eliminates corrosion

**OKONITE**
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# Organization

One of the most significant things about the electrical industry has been its reliance upon co-operative effort through associations to develop standards, promote markets, improve operations and adjust differences. Out of such voluntary effort have come practices that have made the United States the leading nation of the world in utilization of electricity. Now, when National Defense is demanding faster and faster production, America is able to supply two or three times as much electrical energy per capita as any other large nation.

Yet the spirit of working together for a common good is now in jeopardy. Today, of all times, when the nation needs industrial solidarity of purpose and unity of performance, the government through SEC has thrown a cloud over associations.

Section 13 (f) of the Public Utility Act of 1935 states that: "It shall be unlawful for any person whose principal business is the performance of service, sales or construction contracts for public utility or holding companies . . . to take any step in the performance of any service, sales or construction contract . . . in contravention of such rules . . . as the commission deems necessary. . . ." Associations with substantial utility membership are held to be in that group and therefore must register and operate in accordance with SEC rules not yet written. National groups, state groups and even engineering societies with members who work for utilities have been asked by SEC to state their status.

The result has been a filing with SEC by Edison Electric Institute and by one state utility association. Other associations are trying to determine where they stand. Once an organization files with SEC, its member companies that are not amenable to the act begin to question the implications of their continuance in a registered association. Some E.E.I. resignations, affecting approximately one-fifth of that body's revenue, have already taken place and others are under consideration. Some state associations are discussing the advisability of continuance.

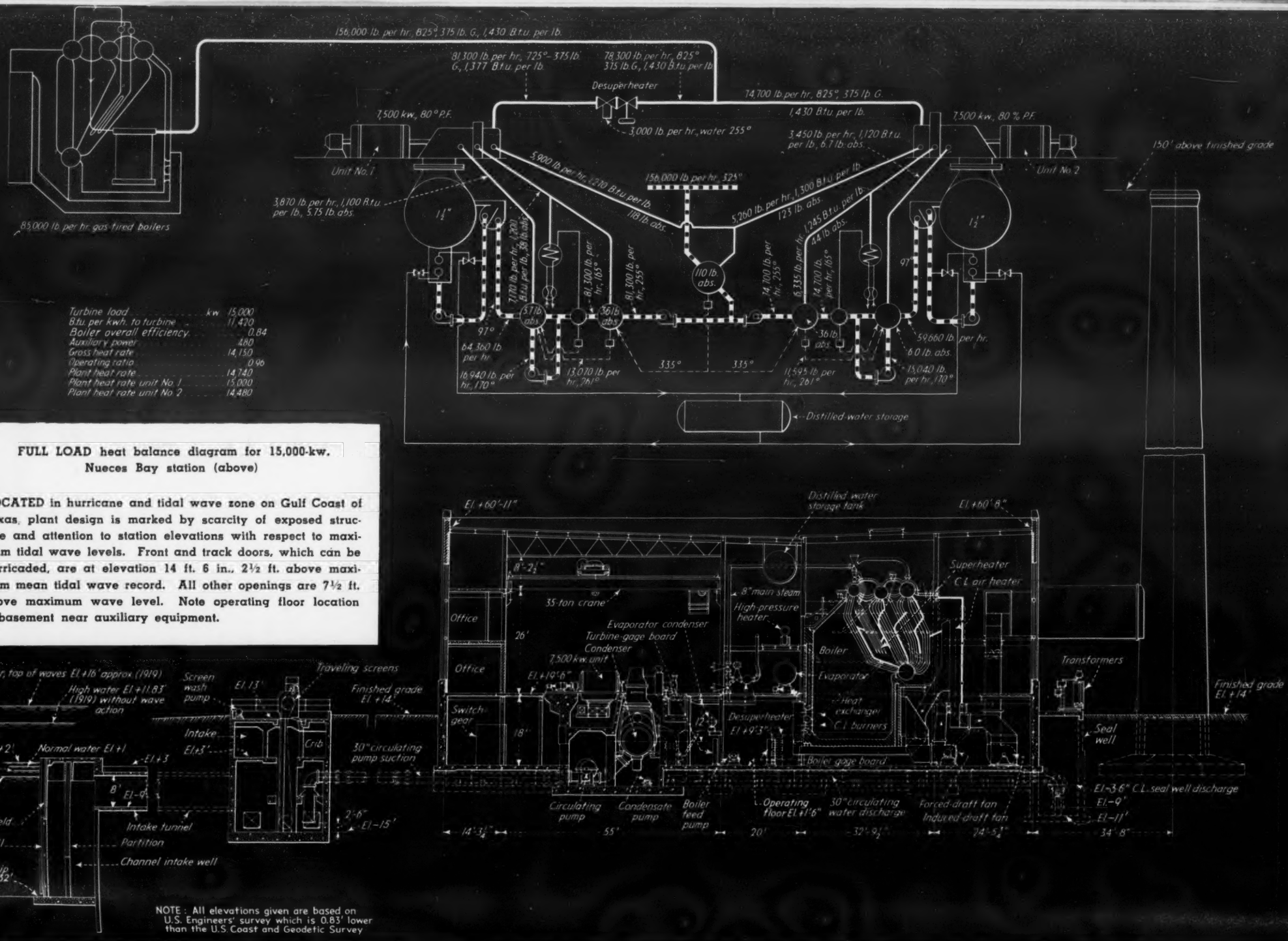
In the meantime, legal talent is searching for some form of association that will be effective and yet not subject to SEC regulation. Whether or not this can be done is not a subject for lay speculation.

Associations can give those in charge of the Defense Program an avenue for getting information to an industry as well as provide facts and decision quickly. The less representative an association becomes in these times the greater is the detriment to the nation.

It does seem, therefore, as though 1941, the critical year of rearmament, is a strange time to invoke the provisions of a six-year-old law, and especially when the commission has not yet got around to setting up the "rules and regulations" specifically called for in the act.

If this move has been timed to come when holding company disintegration programs were scheduled for hearings in order further to weaken the morale of the industry, utility executives should not allow themselves to be stampeded into throwing away the only thing which they now have to hold them together.

Today, of all times, is no time to rely upon individual strength. This is the day of collective action. This is the day when two heads are better than one. This is the day for organization.


156,000 lb. per hr., 825°, 375 lb. G., 1,430 B.t.u. per lb.
81,300 lb. per hr., 725°- 375 lb. G., 1,377 B.t.u. per lb.
78,300 lb. per hr., 825° 375 lb. G., 1,430 B.t.u. per lb.
Desuperheater
74,700 lb. per hr., 825°, 375 lb. G. 1,430 B.t.u. per lb.
7,500 kw., 80° P.F.
7,500 kw., 80 % P.F.
3,000 lb. per hr., water 255°
3,450 lb. per hr., 1,120 B.t.u. per lb., 6.7 lb. abs.
150' above finished grade
Unit No. 1
Unit No. 2
5,900 lb. per hr., 1,270 B.t.u. per lb.
118 lb. abs.
156,000 lb. per hr., 325°
5,260 lb. per hr., 1,300 B.t.u. per lb.
123 lb. abs.
3,810 lb. per hr., 1,100 B.t.u. per lb., 5.75 lb. abs.
1½"
1½"
7,770 lb. per hr., 1,200 B.t.u. per lb., 38 lb. abs.
81,300 lb. per hr., 165°
81,300 lb. per hr., 255°
110 lb. abs.
74,700 lb. per hr., 255°
6,335 lb. per hr., 1,245 B.t.u. per lb.
44 lb. abs.
74,700 lb. per hr., 165°
97°
371 lb. abs.
361 lb. abs.
97°
64,360 lb. per hr.
10,940 lb. per hr., 170°
13,010 lb. per hr., 261°
335°
335°
11,595 lb. per hr., 261°
36 lb. abs.
59,660 lb. per hr.
6.0 lb. abs.
15,040 lb. per hr., 170°
Distilled water storage
85,000 lb. per hr. gas-fired boilers

| | | |
|---|---|---|
| Turbine load | kw | 15,000 |
| B.t.u. per kwh. to turbine | | 11,470 |
| Boiler overall efficiency | | 0.84 |
| Auxiliary power | | 480 |
| Gross heat rate | | 14,150 |
| Operating ratio | | 0.96 |
| Plant heat rate | | 14,740 |
| Plant heat rate unit No. 1 | | 15,000 |
| Plant heat rate unit No. 2 | | 14,480 |

**FULL LOAD heat balance diagram for 15,000-kw. Nueces Bay station (above)**

**LOCATED in hurricane and tidal wave zone on Gulf Coast of Texas, plant design is marked by scarcity of exposed structure and attention to station elevations with respect to maximum tidal wave levels. Front and track doors, which can be barricaded, are at elevation 14 ft. 6 in., 2½ ft. above maximum mean tidal wave record. All other openings are 7½ ft. above maximum wave level. Note operating floor location in basement near auxiliary equipment.**




NOTE: All elevations given are based on U.S. Engineers' survey which is 0.83' lower than the U.S. Coast and Geodetic Survey

# Wind and Flood Precautions Mark Coast Plant Design

*New Nueces Bay base-load station designed for 60,000 kw. ultimate capacity has ideal location on Gulf Coast, in oil fields and at load center — Structures designed for 130-m.p.h. wind — Protected against tidal wave damage*

*J. T. PERSONS* and GEORGE A. MILLS, Central Power & Light Company, Corpus Christi, Tex.*
*JAMES H. BUELL, Middle West Service Corporation, Chicago*

IT IS SELDOM possible to find as favorable a site for a base-load plant as was selected for the Nueces Bay power station of the Central Power & Light Company. This new station, which is to have an ultimate capacity of 60,000 kw., is located on the deep-water ship channel at Corpus Christi, Tex., within a few miles of several natural gas and oil fields and immediately adjacent to the system load center, where unusual load growth is being experienced.

Tropical storms and tidal waves considerably influenced the physical design and arrangement of the Nueces Bay station. Outside tanks and structures were kept at a minimum, exposed parts of the circulating water system were avoided, building and chimney were designed for 130-m.p.h. wind and particular attention was given to plant foundations and operating levels.

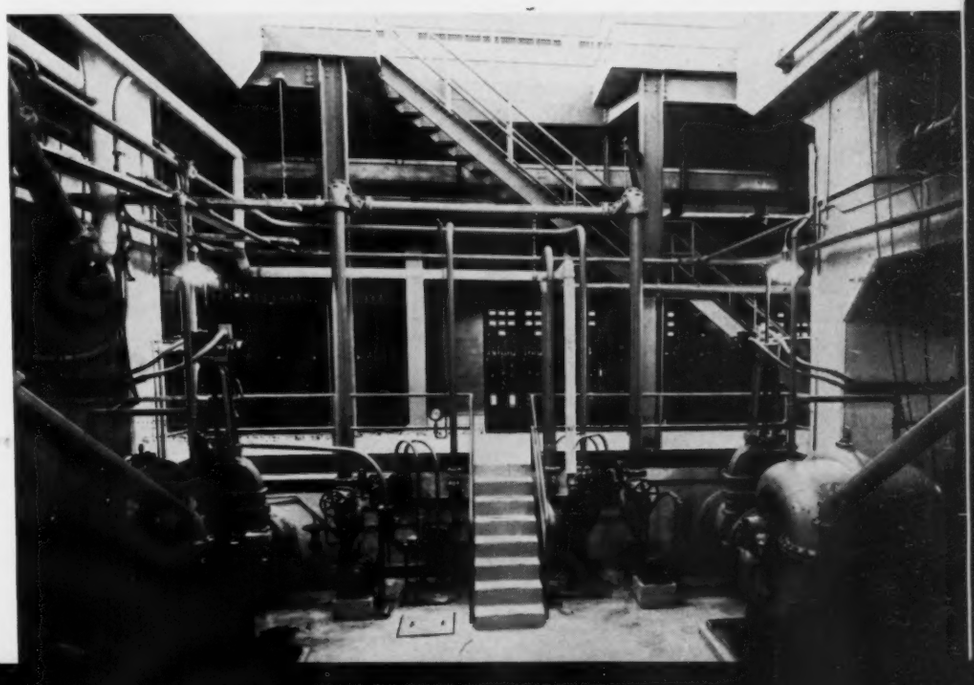
To meet growing load company engineers developed plans for the immediate erection of a base-load plant to have an initial installation consisting of two General Electric 7,500-kw. turbo-generators and a future capacity of 60,000 kw. Sargent & Lundy, Inc., Chicago, handled the design and engineering.

To furnish the needed capacity in the Corpus Christi area before the summer peak of 1940 one 7,500-kw. turbine, condenser and two boilers with complete auxiliary equipment were moved from another company-owned station where excess capacity existed. The second 7,500-kw. unit was purchased. Excavation work was started on the plant site in October, 1939. The first unit was placed in service July 1, 1940, and the second unit September 10, 1940. This construction schedule, though stringent, was carried out by the construction department of the company with very little overtime work. Cost of the initial 15,000-kw. installation was $132 per kilowatt, including substation, submarine cables and water facilities for a future plant capacity of 60,000 kw.

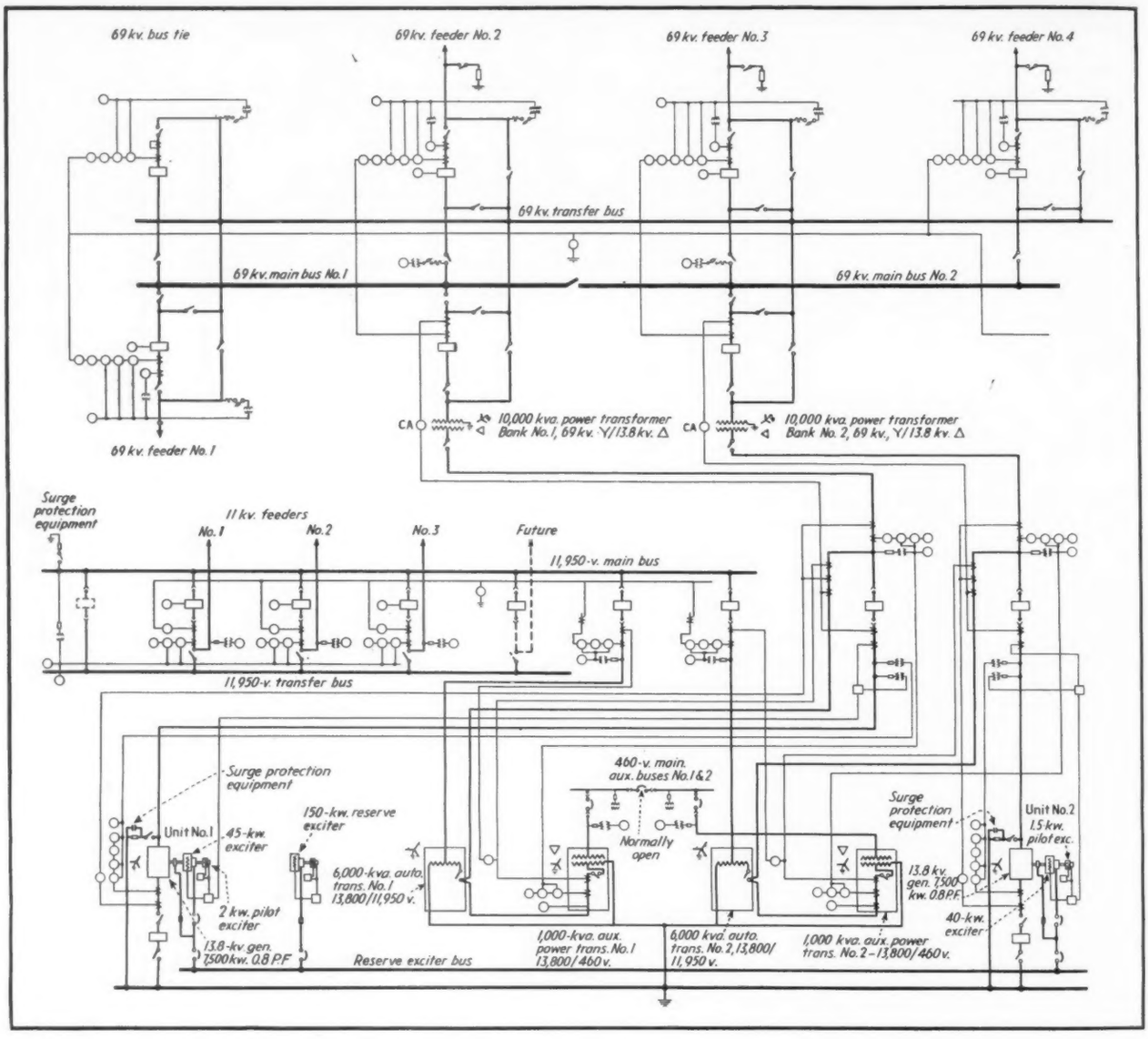
However, before the first 7,500-kw. unit could be placed in operation, in July, 1939, Congress appropriated $25,000,000 for a naval training base at Corpus Christi to be completed in twelve months. The growth of load which will result from the naval base, added to the general growth along the gulf coast of south Texas, prompted officials of the company to authorize a third unit of 15,000 kw. for the Nueces Bay station to be installed and made ready for operation early in 1942, bringing the total installed capacity of the station to 30,000 kw. The cost of the 30,000-kw. station will average $110 per kilowatt, including transmission terminal facilities.

The reinstalled 7,500-kw. turbine was designed for operation with steam at 375 lb. per sq.in. gauge and 725 deg. total temperature at the turbine. The new 7,500-kw. turbo-generator

**OPERATING LEVEL in basement of the plant at 1 ft. 6 in. level looking toward electrical operating center in background. In foreground are circulating pumps, ejectors and other equipment. Combustion control area, also on this level, faces electrical control area. Operators communicate over loud speaker system**



* Chief engineer.


69 kv. bus tie
69 kv. feeder No. 2
69 kv. feeder No. 3
69 kv. feeder No. 4
69 kv. transfer bus
69 kv. main bus No. 1
69 kv. main bus No. 2
69 kv. feeder No. 1
CA
10,000 kva. power transformer Bank No. 1, 69 kv. Y/13.8 kv. Δ
CA
10,000 kva. power transformer Bank No. 2, 69 kv., Y/13.8 kv. Δ
Surge protection equipment
11 kv. feeders
No. 1
No. 2
No. 3
Future
11,950-v. main bus
11,950-v. transfer bus
460-v. main aux. buses No. 1 & 2
Surge protection equipment
Unit No. 1
45-kw. exciter
150-kw. reserve exciter
2 kw. pilot exciter
13.8-kv. gen. 7,500 kw. 0.8 P.F.
6,000-kva. auto. trans. No. 1 13,800/11,950 v.
Normally open
Reserve exciter bus
1,000-kva. aux. power trans. No. 1 13,800/460 v.
6,000 kva. auto. trans. No. 2, 13,800/11,950 v.
1,000 kva. aux. power trans. No. 2 – 13,800/460 v.
Surge protection equipment
Unit No. 2
1.5 kw. pilot exc.
13.8 kv. gen. 7,500 kw. 0.8 P.F.
40-kw. exciter

**ELECTRICAL system layout**

was purchased to operate at 375 lb. pressure and 825 deg. total temperature. While both of the reinstalled boilers have a steaming capacity of 85,000 lb. per hour at 425 lb. per sq.in. pressure, one delivers steam with a total temperature of 725 deg. and the other 835 deg. The higher temperature boiler, for the new turbine, was revamped by adding a new superheater header and tubes. Both boilers were retubed and modernized with steam washers and chemical feed troughs located in the back boiler drums. A desuperheater was installed between the two boilers to allow the high temperature boiler to supply the low temperature turbine in emergency.

Study of the pressure and temperature conditions of the new 7,500-kw. unit and the 15,000-kw. unit now being installed showed that because of the low fuel cost the saving in operating cost with higher pressure than 425 lb. was not sufficient to justify the increased investment. The present plant will operate at an annual load factor of about 75 per cent with a heat rate of 14,740 B.t.u. per kw.-hr. output, using gas fuel with a heat value of 1,099 B.t.u. per cu.ft.

When reinstalling the No. 1 unit changes were made to modernize the condenser and boiler feed system in line with that for the new 7,500-kw. No. 2 unit. As shown in the accompanying diagram, a closed system was used with a common high-pressure heater and individual intermediate and low-pressure heaters, accomplishing the deaerating in the condenser. With the use of a 1,500-gal. make-up tank with float valve control, a constant level is maintained in the hot well. The make-up tank is connected to distilled water storage tanks, so that an ample supply of condensate or distilled water is available. Supply from the make-up tank is deaerated by passing through the condenser on its way to the hot well. Condensate in excess of boiler feed requirements passes back to the make-up tank or distilled water tanks after being discharged from the condensate pumps.

Both boilers were re-erected with the same pre-heaters, forced and induced draft fans, but with revised design of air-cooled walls. Bubble-type steam washers and chemical feed troughs were added to both boilers. Plastic cross-flow baffles were used in both boilers. In No. 2 boiler a by-pass damper was inserted in the second baffle just below the middle drum

back of the superheater to control the superheat temperature at high boiler loads. Automatic boiler feed regulators and electropneumatic combustion control were installed to control completely gas valves and forced and induced draft fan dampers.

City water is used to supply make-up to the evaporators and to supply sanitary service. A 5,000-gal. storage tank is used for reserve supply. Two 5,000-gal. distilled water tanks are provided for distilled water supply.

### *Storm-Proof Features*

Since the plant is on the Gulf Coast in the tropical hurricane belt some notable departures from conventional station layout and design were necessary. Outside tanks and plant structures were reduced to a minimum. Concrete, steel and brick building and the concrete chimney were designed for a wind velocity of 130 m.p.h. Particular attention was given to protecting the plant against tidal waves. The maximum mean tidal wave recorded in this area was 12 ft. above sea level.

City water and distilled water tanks are supported from the roof trusses within the building. The auxiliary oil tank was placed underground under a one-story concrete and brick oil pump house. Traveling screens of the outdoor type were installed on a platform 13 ft. above sea level and surrounded with a curb 15 ft. above sea level. At the channel the intake crib was located on the north bank, with no exposed parts and with the platform over the crib at 3 ft. elevation above sea level. A salt water heat exchanger has been installed for cooling bearing cooling water to eliminate an exposed cooling tower. All operating pumps, except backwash pumps for the traveling screens, are in the building.

Sea water is used for condensers, generator oil coolers, turbine oil coolers, and with heat exchanger for cooling bearing cooling water. Water from the 32-ft. deep ship channel enters the forebay crib between 20 ft. and 32 ft. below sea level. The relatively high surface water temperature in Nueces Bay, which is but a few hundred miles north of the tropical zone, influences the arrangement of the condenser water intake crib which takes water from the floor of the ship channel 20 ft. below sea level, where water temperature is 9 deg. cooler than that taken from Corpus Christi Bay at the company's Water Street plant.

The forebay crib, constructed of Z-section copper-bearing-steel piling, is covered with a concrete slab located 3 ft. above sea level. The concrete floor is 32 ft. below sea level. To cut off the upper 20 ft. of water a shield has been provided. Below 20 ft. a rack keeps débris and jellyfish from entering the duct to the plant. Sea water flows to the screen crib through a 565-ft. long duct that has a cross-section of 6 x 8 ft. Floor of the water intake duct is 9 ft. below sea level. Both forebay crib and duct are designed for a future plant capacity of 60,000 kw.

There are three double compartments in the present reinforced concrete screen crib, two of which are equipped with 94-in. wide outdoor type traveling screens fitted with No. 10 B & S gauge Swedish iron wire screen cloth having $\frac{3}{8}$-in. square openings, one for each 7,500-kw. unit. The concrete screen crib was cast in sections and jetted into place to reduce the cost of excavation and overcome the problem of holding the crib on an unstable bottom of wet clay and silt 17 ft. below sea level.

As shown in the cross-section view of the plant, the circulating water is carried through 30-in. cast-iron, cement-lined pipe to the condensers and through the building to the seal well. The center of this pipe is located at elevations below main sea level, therefore circulating pump suction is normally supplied with water flowing to the pump by gravity. A siphoning action through the condensers reduces the total head, so the resultant net head is only condenser friction and pipe friction. The result is a low pumping cost. From the seal well the discharge water passes through about 200 ft. of concrete pipe and duct to an open channel which discharges into Nueces Bay.

Circulating water piping to the generator air cooler and turbine oil cooler is in parallel with the condenser circulating water piping, using the same pump and siphon system. The entire circulating system is simple and compact, providing economical operation.

### *Operating Floor in Basement*

A simplified operating arrangement was worked out by locating all controls so they may be supervised from the 1-ft. 6-in. elevation floor, where practically all equipment is located. Combustion equipment control area is in front of the boilers, facing the electric control area, so that the switchboard operator is not

[*Continued on page 126*]

**NUECES BAY station at Corpus Christi, Tex.; ultimate capacity 60,000 kw., initial capacity 15,000 kw.**

# Economical Answers to Distribution Voltage Regulation

***Synchronous condenser, bus regulation at substation and combination of capacitors and step-voltage boosters found effective to provide voltage regulation for rapidly growing load***

*P. J. CARLIN and L. L. STAHLER,* Florida Power & Light Company, Miami*

METHODS and equipment available to the distribution engineer of today for improving voltage regulation are larger for a greater number of conductors, higher distribution voltages, synchronous condensers, step-voltage boosters, static capacitors, induction voltage regulators and step-voltage regulators. Regulation can be improved by the installation of larger conductors on existing circuits or the installation of additional circuits both of which have distinct economical limits.

* Adapted from a recent paper presented before Southeastern Electric Exchange, Engineering and Operation Section.

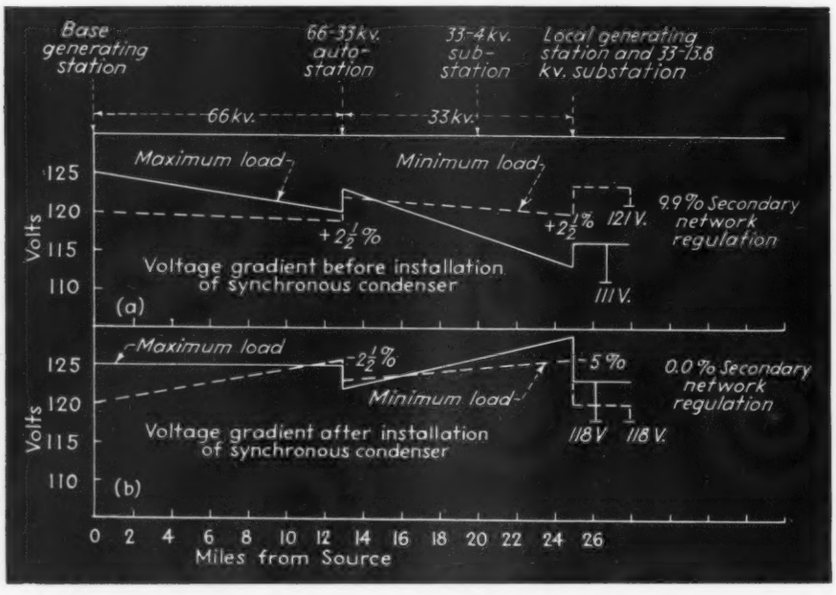
Distribution system regulation can be improved by increasing the primary voltage, such as converting a 2.4-kv. delta system to 4-kv. wye, or by the use of even higher voltages ranging upward to 13.2 kv. The wye voltages are especially to be recommended since it is possible to use less expensive equipment on these lines, such as cut-outs, arresters and transformers, with consequent reduction in investment and with no sacrifice in performance as compared to the same delta voltage. It is now common practice to use the secondary neutral as a common neutral for both the primary and secondary system, making it possible to convert a delta system to wye with the addition of very little additional copper.

Since one primary terminal of each transformer on a wye system is operating at ground potential only one arrester and one cut-out are required, making it possible to salvage one-half of the protective equipment when converting a delta system to wye. The value of this salvaged equipment is sometimes greater than the cost of converting a delta system to wye, with the rather surprising result that the capacity of the system is tripled at no cost. Experience has shown that the interconnection of transformer cases, primary and secondary neutrals and arresters which become possible on a wye system results in reduced transformer outages and damage from lightning.

Synchronous condensers are especially applicable for improving regulation where it is desired to maintain constant voltage at a given point or where it is desirable to reduce reactive load on a transmission line or generator, with consequent increase in transmission or generating capacity.

Step-voltage boosters are an inexpensive means of improving voltage regulation on distribution laterals which are lightly loaded and can frequently be used to defer a much larger investment in copper or other means of permanent correction.

Static capacitors have only recently entered the regulating field, having been used in the past chiefly for power-factor correction without respect to voltage regulation. Capacitors of themselves do not improve




**TYPICAL voltage gradients before and after installing 15,000-kva. synchronous condenser**

(a) Before installation. Graph shows regulation which would have been experienced with local generating station shut down and not the actual regulation on the secondary network.

(b) After condenser installation. Actual network voltage independent of local generating plant operation. The plant is now operated only as required for system capacity.

regulation, but merely tend to raise the voltage level and, in fact, increase the width of the existing regulating band. When installed for improving regulation, capacitors should be installed on regulated circuits, or should be equipped with auxiliary equipment for switching as dictated by service requirements.

Induction voltage regulators and step-voltage regulators are still the backlog of any major regulation problem since they are able to handle large blocks of power and can be adjusted for very close voltage limits.

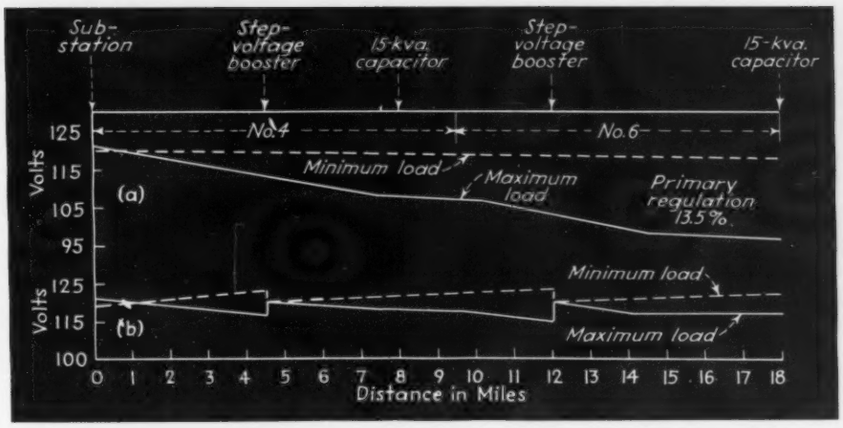
### *Regulating Devices Installed*

Application of these various alternatives on the Florida Power & Light system to meet voltage regulation problems which have arisen in conjunction with rapidly increasing load has resulted in the installation of the following additional facilities in the last five years:

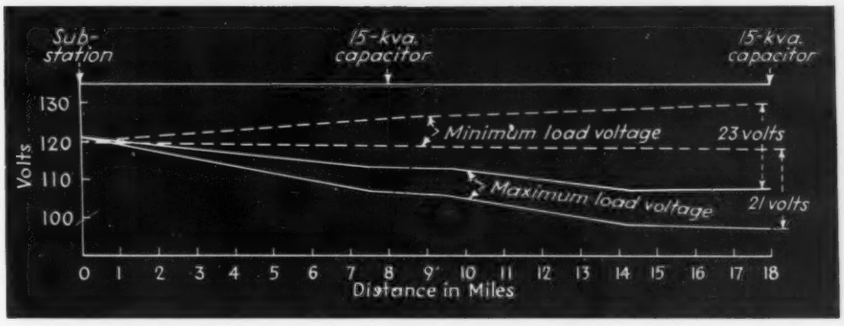
| | |
|---|---|
| Step-voltage boosters | 50 |
| One synchronous condenser, kva | 15,000 |
| Capacitors (shunt), kva | 6,000 |

A number of induction voltage regulators were also added to the system during this period and there are now approximately 90 banks in service. The above facilities were supplemented by increased size of primary wire wherever that was an economical move. The magnitude of the voltage regulation problem can be inferred from the fact that the peak loads did not differ widely between 1926 and 1936 from the value of 92,000 kw. for 1936. However, in the four years from 1936 to 1940 the peak increased 65 per cent to a 1940 value of 152,000 kw. In that interval development of South Florida has continued at an unprecedented rate, resulting in unpredictable load increases and continuous increments to system capacity.

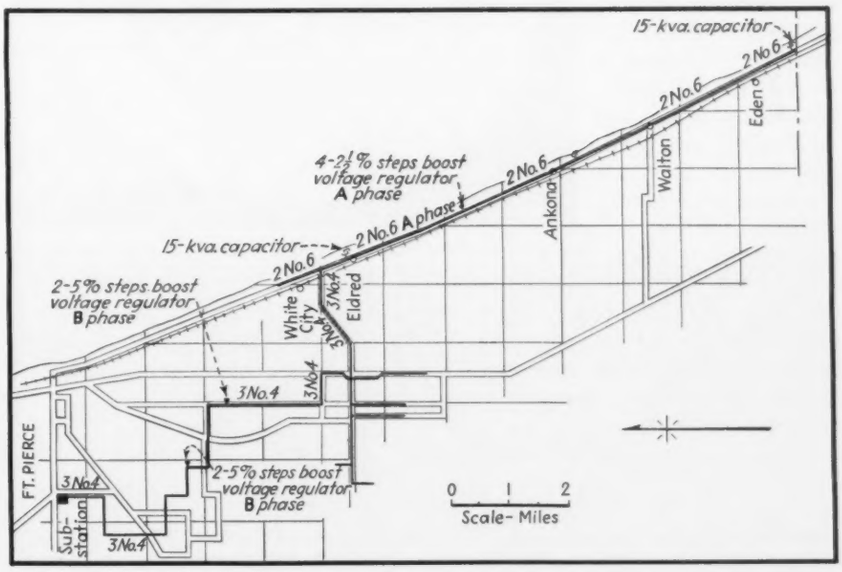
Another factor which should be appreciated before taking up the details of certain typical regulation problems is the Miami underground secondary network. This secondary network system is served at 13.2 kv. wye, unregulated from the Miami steam-electric station 13.2-kv. bus, and is located approximately 25 miles from a base generating plant. Until recently the voltage level on this network was controlled by varying the bus voltage at the local generating station, or when the local station was not in operation it was controlled by varying the bus voltage at the base generating station. The load on this network is basically commercial, with a large block of air-conditioning load which peaks at from 2 to 4 p.m., while the remainder of the system has a lighting peak.




**NOTABLE IMPROVEMENT** in voltage results from introduction of capacitors in conjunction with step-voltage regulators. This is for the area and equipment locations shown in an accompanying illustration




**SOME FORM** of regulator equipment was needed with capacitors in absence of on-and-off switching of capacitors




**NINE-MILE AREA** had load growth which occasioned excessive primary and secondary regulation connected by combination of capacitors and step-voltage regulators at strategic points as shown

The variation in time of peak between this network and the remainder of the system, coupled with the method of regulating the network voltage, resulted in a maximum system voltage at the time of the Miami network peak and a lower system voltage at

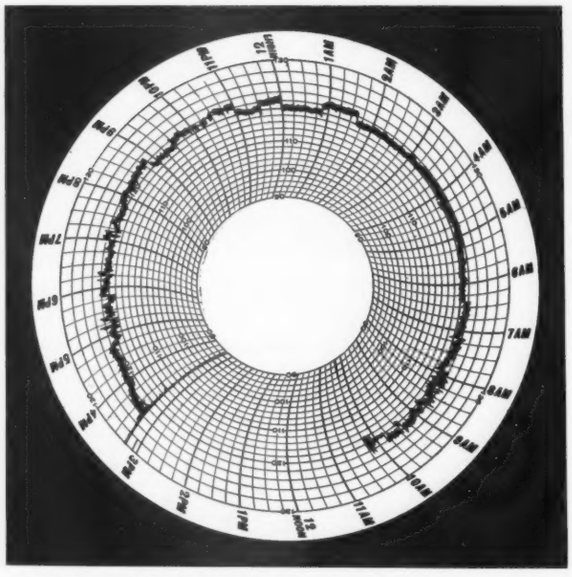
system peak load periods. This condition was especially undesirable due to the large number of unregulated feeders on the system and materially reduced the capacity of those feeders which were regulated.

By 1937 the system load had increased to a point where it was necessary to formulate plans to make the system voltage level independent of the momentary voltage requirements of the network.

### *Comprehensive Study Made*

Careful and exhaustive study of the entire system was made, including power factor and voltage levels at the various substations, the power factor at the generators, generating capacity, network voltage requirements, etc.

It was found that the bus voltage was low at substations between the base generating plant and the network, seriously reducing the capacity of the feeders out of these substations. The base generating plant was operating at full load at a power factor of approximately 80 per cent, a condition which precluded the possibility of further raising the system voltage even if regulators were to be installed on the network.



**STEP-VOLTAGE BOOSTER bucks the rise due to capacitors to give smooth voltage**

As a result of the data collected it was decided to install a 15,000-kva. synchronous condenser in the local station for the dual purpose of regulating the network voltage and reducing the reactive load on the system, permitting a greater load to be carried on the base generating station, or permitting the system voltage to be raised to a higher level. This plan was completed in 1939 and has given even more than the anticipated results.

Conditions on the system are peculiarly favorable for efficient condenser operation as there are two transformer banks in the transmission system between the base generating plant and the condenser, and by changing the transformer taps the load on the condenser can be varied as load conditions on the system require.

Usefulness of this synchronous condenser as a voltage regulating medium has been further increased by operating its voltage control relay from a pilot wire which is energized from the approximate center of the network. Further improvement in voltage control is obtained by manually varying the resistance in the voltage control relay circuit to maintain secondary network voltage ranging from 119 to 121, as dictated by service requirements.

This, in effect, is an effort to compensate for secondary and service voltage drops and could be accomplished automatically if desired. Since there are operators on duty at the local generating plant at all hours it is not considered necessary to install this automatic equipment.

### *Condenser Beneficial*

This problem of network voltage regulation was apparently quite simple of solution, requiring only the installation of regulators, and this solution would have accomplished that result and only that; the synchronous condenser, while installed at somewhat greater cost, has improved the system in several ways: First, it accomplished the primary purpose of making the system operation independent of the momentary requirements of the network; second, it removed approximately 18,000 kva. from the base generating plant, decreasing the load on, or increasing the capacity of, the system approximately 5,000 kva., and raised the bus voltage at all intermediate substations, thereby materially increasing the capacity of the feeders from those substations.

Evaluating only the increased system capacity of approximately 5,000 kva. which was realized through the installation of this synchronous condenser, it is found that an investment in an equivalent amount of generating capacity would have cost approximately $400,000, or approximately three times the cost of the condenser.

While synchronous condensers and static capacitors perform a common function—that of reducing the reactive load on a system, thereby reducing the voltage drop—their successful application depends upon entirely different conditions.

A synchronous condenser is automatic in its operation, varying its load from moment to moment to maintain a predetermined voltage level on the condenser bus, or by the use of a control circuit it will maintain a predetermined voltage at some remote point on the system and is a piece of true regulating equipment.

### *Capacitors*

Capacitors are usually installed in relatively small groups of from 15 to 180 kva. capacity connected directly to the distribution system, and since their capacity varies as the square of the exciting voltage, they not only cause a rise in voltage under peak-load conditions but cause a further voltage rise during light load conditions, when the distribution voltage is usually at the highest level, and as a result increase the regulation on the system.

From this it is evident that static capacitors are not to be considered as regulating equipment unless installed with automatic switching equipment which will de-energize part or all of the capacitors as the system voltage rises and re-energize the capacitors as the system voltage falls.

Since the cost of such automatic switching equipment is prohibitive for a small installation of capacitors, their application is usually limited to distribution circuits which are regulated, or where they can be installed

[*Continued on page 142*]

# Branch-Fuse Policy Set by Fault Ratio and Loading

***Criterion for use of one-shot and reclosing branch-line fusing rests on relative loading and relative durations of permanent and temporary faults***

***P. E. BENNER,* General Electric Company, Schenectady, N. Y.***

WHICH is better—to have temporary faults on branch circuits cause prolonged outages on that branch or to have permanent faults on branch circuits cause prolonged outages on the whole feeder? Using kva.-hours outage as the measure of performance, there is a correct answer to this question, and so the subject of branch fusing is debatable only in the absence of factual information to obtain that answer. Data required are:

$f$=per cent of total faults which are temporary.

$F$=per cent of total faults which are permanent.

$b$=per cent of total feeder load on a particular branch circuit.

$r$=duration of outage due to permanent fault divided by duration of outage due to temporary fault.

On this basis the relative duration of a temporary fault is one.

Permanent faults are considered as those which require the attention of a line crew to restore service, whereas temporary faults are those which will clear themselves with the interruption of power, before the first or second reclosure of the breaker or fuse cutout.

In considering kva.-hours of outage, attention cannot be confined to any particular branch circuit, but must be given to the kva.-hours outage of the entire feeder. When a branch circuit is fused, and it is assumed that the outages caused by the blowing of branch circuit fuses are of the same duration, whether caused by a permanent or a temporary fault,

*Central station engineering department.

$$\left.\begin{matrix}\text{Kva.-hours of}\\ \text{outage of feeder}\\ \text{due to branch-}\\ \text{line faults}\end{matrix}\right\} = K\,(b\,r\,f_{\text{Branch}} + b\,r\,F_{\text{Branch}}) \qquad (1)$$

where $K$ = (feeder load in kva.) × (total number of faults on branch circuit) × (duration of temporary fault in hours)

On the same basis

$$\left.\begin{matrix}\text{Kva.-hours outage}\\ \text{for entire feeder}\\ \text{without branch}\\ \text{fuses due to faults}\\ \text{on branch circuit}\end{matrix}\right\} = K\,(1\,f_{\text{Branch}} + r\,F_{\text{Branch}}) \qquad (2)$$

Obviously, if the kva.-hours of outage for the whole circuit, due to faults on the branch circuit, as determined from the above formulas are proportionately lower with branch circuit fuses, benefits from their use are indicated. It should be noted that, in order not to unduly complicate the analysis, no allowance has been made

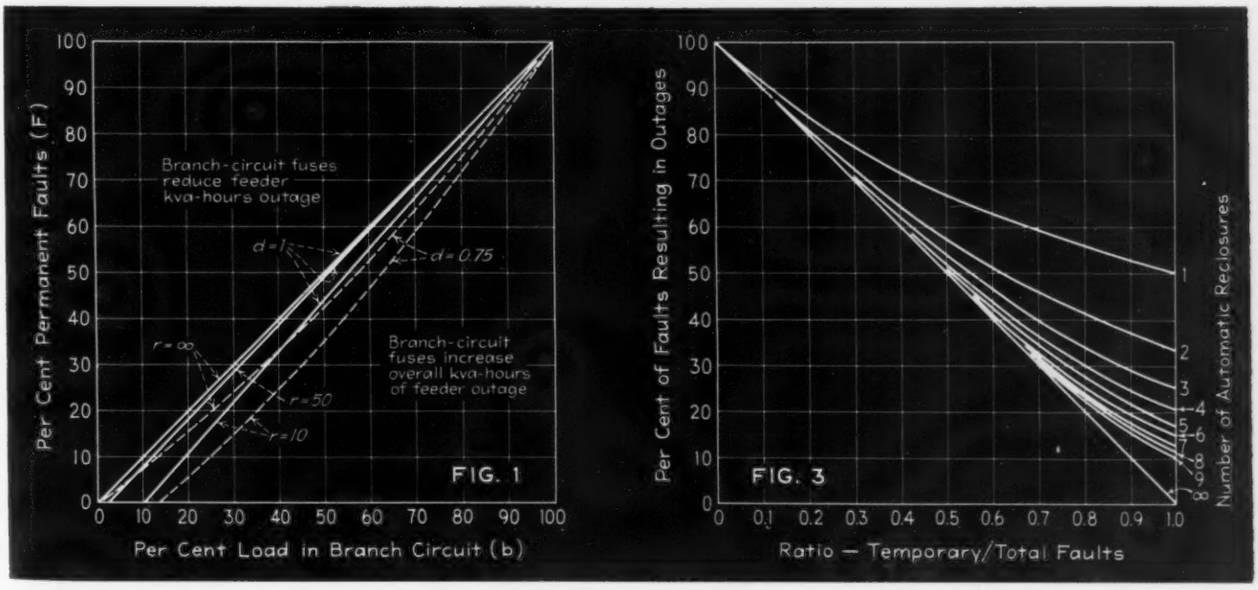



**FIG. 1—HOW to decide on appropriateness of branch fusing. Criterion takes account of fault ratio, loading, duration of fault and duration of fuse-blow outage. FIG. 3—EFFECT of automatic reclosures on per cent of faults resulting in outages**

for any advantage which the use of branch-line fuses may have from the standpoint of expediting the location of faults with the consequent reduction in the duration of an outage.

### *Dividing Line*

The dividing line for branch fuse application occurs where the kva.-hours of outage with branch fuses as determined by (1) equal the kva.-hours of outage without branch fuses (2). This dividing line will, of course, vary with assumed conditions, but in any case can be located as a function of $b$ and $F$ by equating (1) and (2) and solving for $b$ in terms of $F$, thus:

$$K\,(br\,f + br\,F) = K\,(f + r\,F)$$

$$b = \frac{f + r\,F}{r\,(f + F)} \qquad (3)$$

The solid curves in Fig. 1 were plotted from (3) to provide an easy means for analyzing branch circuits from the standpoint of the application of branch circuit fuses. Three curves are shown to cover the range of possible relative durations of permanent versus temporary faults. If, in a given case, permanent faults average 50 minutes in length and temporary faults one minute in length, the relative duration of permanent faults versus temporary faults would be 50 and the curve labeled $r=50$ would be used. Any point falling above the curve when plotted with the per cent of permanent faults as the ordinate and the per cent load in the particular branch under consideration as the abscissa would indicate the use of branch circuit fuses to reduce the kva.-hours outage for the entire feeder circuit. A point plotted in the same way from the data on a branch circuit and falling below the curve shows that the use of branch circuit fuses would increase the over-all kva.-hours outage of the feeder.

In plotting the solid curves in Fig. 1 the outages caused by the blowing of branch circuit fuses were assumed to be of the same duration whether caused by a permanent or a temporary fault. If experience indicates that outages caused by the blowing of branch circuit fuses due to temporary faults are appreciably shorter in average duration than those caused by the blowing of branch circuit fuses due to permanent faults, equation (3) can be factored accordingly. It is simply necessary to include the factor $(d)$ which is the ratio of

$$\frac{\text{length of outage caused by fuse blown by temporary fault}}{\text{length of outage caused by fuse blown by permanent fault}}$$

Equation (3) then becomes

$$b = \frac{f + r\,F}{r\,(df + F)} \qquad (4)$$

The dash curves in Fig. 1 were plotted assuming $d=0.75$

Ordinarily the outages due to permanent faults average 30 to 45 minutes in length in comparison to outage durations of one to 30 seconds for temporary faults. The relative duration of permanent faults $(r)$ would usually be quite large, and so for most practical applications the curves in Fig. 1 marked $r=\infty$ can be used.

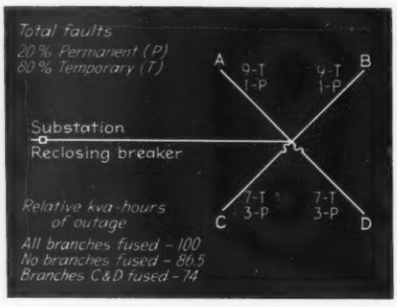



**FIG. 2—TYPICAL example studies of fusing from standpoint of characteristics of individual branches. The conclusion is that only branches C and D should be fused**

### *Analyze Each Branch*

In studying the application of branch circuit fuses it is important that each branch be analyzed individually if the best performance is to be obtained. To show the necessity of the individual analysis of each branch circuit for branch fuse application, consider the feeder circuit (Fig. 2) having four branches, A, B, C and D, all approximately equally loaded. Suppose that records show that on this feeder as a whole 80 per cent of the faults are temporary and 20 per cent are permanent. If the relative duration of the permanent versus temporary faults is 50, it will be seen from Fig. 1 ($r=50$, $d=1$) that, considering the feeder as a whole, branch fuses should not be used. However, suppose that a more detailed analysis of the fault record shows that the ratios of temporary to permanent faults are not the same in all branches, but are as shown in Fig. 2. Individual analysis of the various circuits indicate the use of branch fuses on C and D, and not on A and B. Comparing the over-all kva.-hour outages of the feeder with no branch fuses on any of the branch circuits, and with branches C and D fused, it is found that the use of branch fuses on C and D will result in a reduction of kva.-hours feeder outage of about 15 per cent.

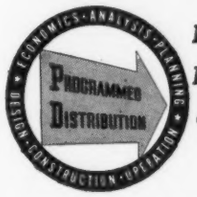
In first analyzing a feeder for branch circuit fuse application it will usually be necessary to base the study on the fault ratio of the entire feeder, as fault ratio information is ordinarily available only from the records of circuit breaker operations. After the installation of branch circuit fuses it is important to keep records of their operation to check the per cent of blowings which result from temporary and permanent faults respectively to insure that expected benefits are being obtained.

### *Reclosing Branch Line Fuses*

Availability of the low-cost reclosing door for standard cutout housings naturally raises the question of the effect of one or more reclosures in the application of branch circuit fuses. The foregoing analysis can be easily extended to include the effect of one or more reclosures of the branch line fuse by making use of the curves in Fig. 3 in conjunction with Fig. 1. The procedure is simply to modify the per cent load in the branch circuit by the per cent of faults resulting in outages when the reclosing device is used. For example, suppose the records of the branch circuit under consideration showed that it carried 30 per cent of the total feeder load and that 25 per cent of the faults occurring on the branch circuit were permanent. Referring these values to the curve $r = 50$ and $d = 1$ in Fig. 1, it will be seen that this would not be an application for a conventional fuse cutout. If, however, a fuse making one reclosure is to be considered, from Fig. 3 it will be seen that for 25 per cent permanent faults approximately 57 per cent of the faults would result in outages. Applying this factor of 57 per cent of the faults to the 30 per cent load in the branch circuit, an equivalent load of approximately 17 per cent is obtained, which, when referred to curve $r = 50$ and $d = 1$ in

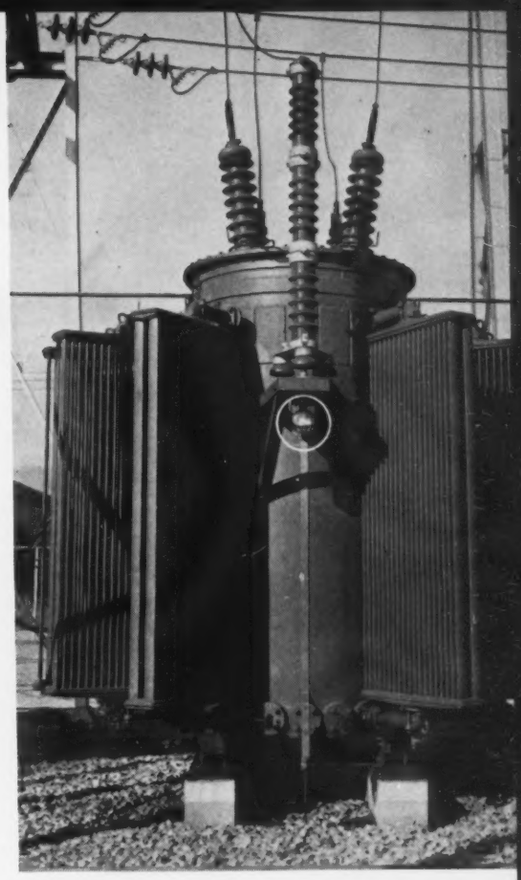
[*Continued on page 130*]

# Arrester Discharge Counter Aids Operation




***Research device has become installation fixture on 69-kv. arresters — Records prove insulation co-ordination and indicate operating behavior of arresters on surges***

*E. R. WHITEHEAD, Duquesne Light Company, Pittsburgh*



**LIGHTNING discharge counter mounted on 69-k power transformer in conjuction with Thyrite line-ty arresters**

Discharge counter is connected in series with arrest ground lead and is located immediately below the arrest

IN THE PERIOD from 1931 to 1936 the Duquesne Light Company carried out a broad program of insulation co-ordination involving many improvements to station insulation and the installation of modern arresters.* It was considered highly desirable to verify the co-ordination in some way, and a demand arose for a simple lightning arrester operation register which would count the number of times the lightning arrester functioned. An experimental device was designed and applied in thirteen 22-kv. substations selected to act as a sample of 22-kv. equipment and protection.

Originally designed primarily as a research device, the lightning arrester discharge counter is now considered a valuable aid to operating and maintenance men. Frequent abnormal registrations are reliably indicative of arrester disorder to a degree hazardous to service and personnel and constitute a warning not to be lightly dismissed.

In the early experience with this discharge counter a line type 73-kv. arrester was found to have discharged more than 5,000 times in a relatively few days. The station operator believed the counter faulty and returned it to the laboratory for checking. Shortly after removing the counter the arrester failed in service during a heavy fog. Subsequent careful attention to such unusual and frequent arrester operations was a means of preventing some old arresters from reaching a stage of incipient failure. These events resulted in reconditioning of such arresters and in developing a vigilant respect for counter readings on the part of station operators.

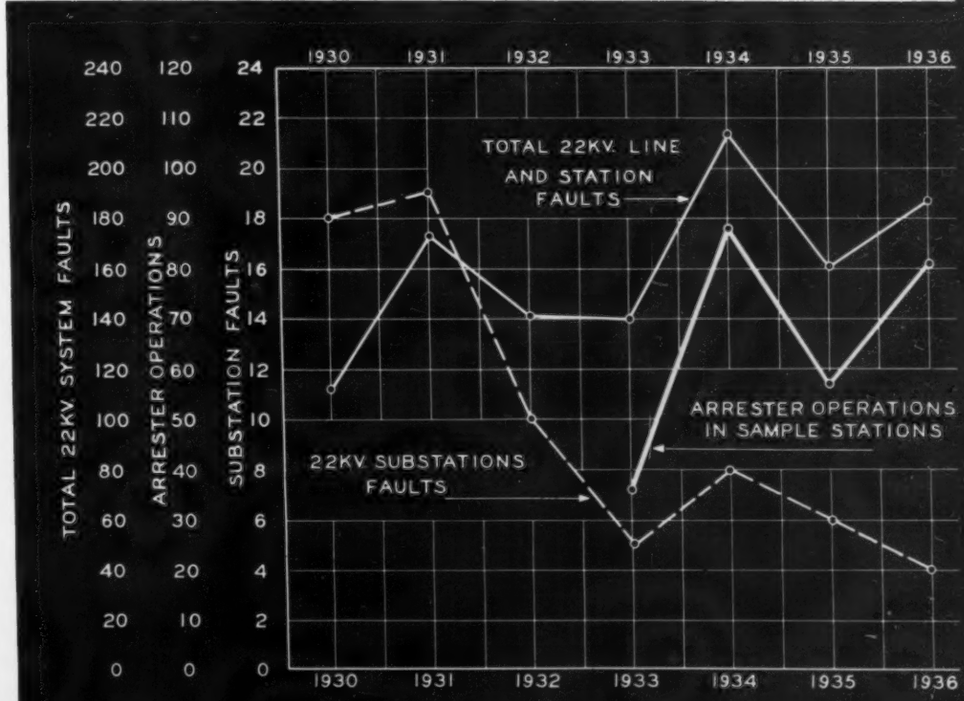
Principle of operation of the discharge counter is that of charging a capacitor through a series and shunt arrangement of "Thyrite" disks whereby the energy of the discharge current through the arrester will actuate a solenoid-operated counter. The discharge counter is installed between the arrester ground terminal and ground, having no measurable effect on the protective characteristics or protection level of the arrester, and the follow current attending discharge of conventional valve-type lightning arresters has no injurious effect upon the discharge counter.

This device has become standard equipment for installation with each single-pole station type 69-kv. arrester and for transformer-mounted arresters of either line or station type on the Duquesne Light Company's system. All 69-kv. line type arresters installed in transmission substations

[*Continued on page 66*]

**EARLY FORM of counters showed expected correlation between faults and arrester operations**

Total lightning faults on 22-kv. system, 22-kv. substation faults and lightning arrester operations in sample substations. Each lightning trip-out sends a traveling wave into substations at each end of the line.




* See "Lightning Protection of 22-kv. Substations," by E. R. Whitehead, Electrical Engineering (A.I.E.E. Transactions), October, 1938, pages 568-572 inclusive.

# Thermal Demand Meters Gang-Tested in Shop

***Toronto system uses test bench to check up to 48 thermals in one batch to take advantage of run deviation — Automatic controls of voltage and loading reduce demands on tester's attention***

*J. ECKERSLEY,* Toronto Hydro-Electric System*

THE USE of demand meters, in conjunction with kilowatt-hour meters, for determining the charges to be made to consumers has been standard practice for a considerable period. In the past this has applied more to the larger installations; now many utilities are installing demand meters on the smaller power and commercial services.

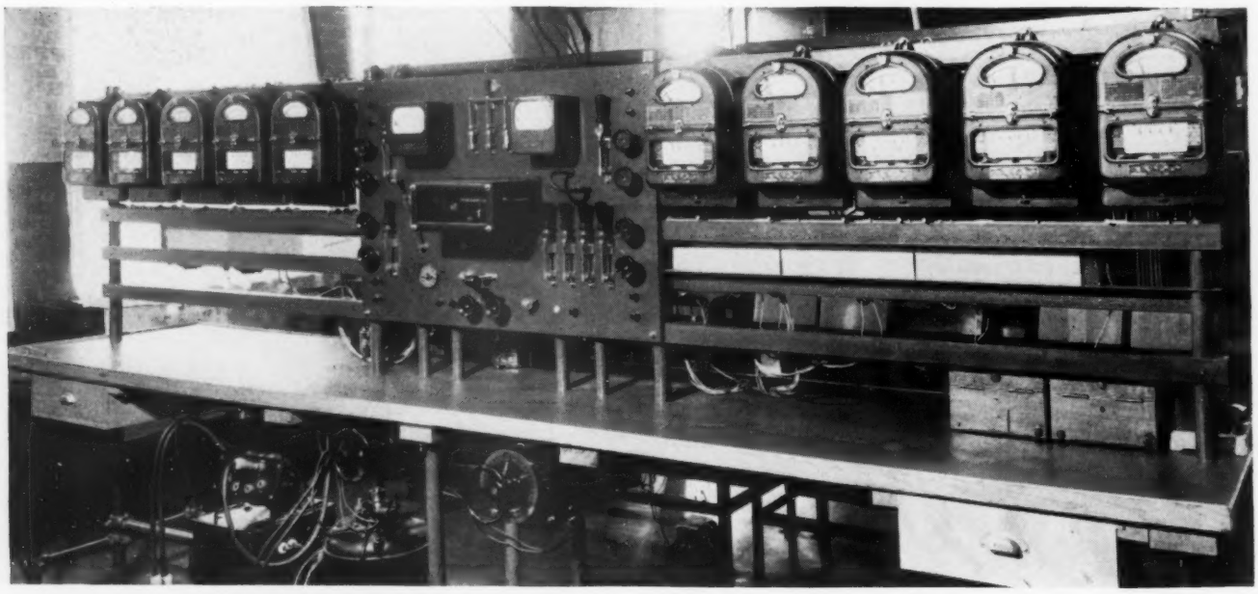
The means of measuring this demand have been supplied by the various meter manufacturers, and this article deals with the testing of the thermal type demand meter on the services of the Toronto Hydro-Electric System.

* Engineer in charge of meter division.

In 1919 the Toronto System put into service thermal type meters of the Lincoln type and has gradually extended the use of them on the power and commercial services. There are about 8,000 thermal demand meters in use on the system.

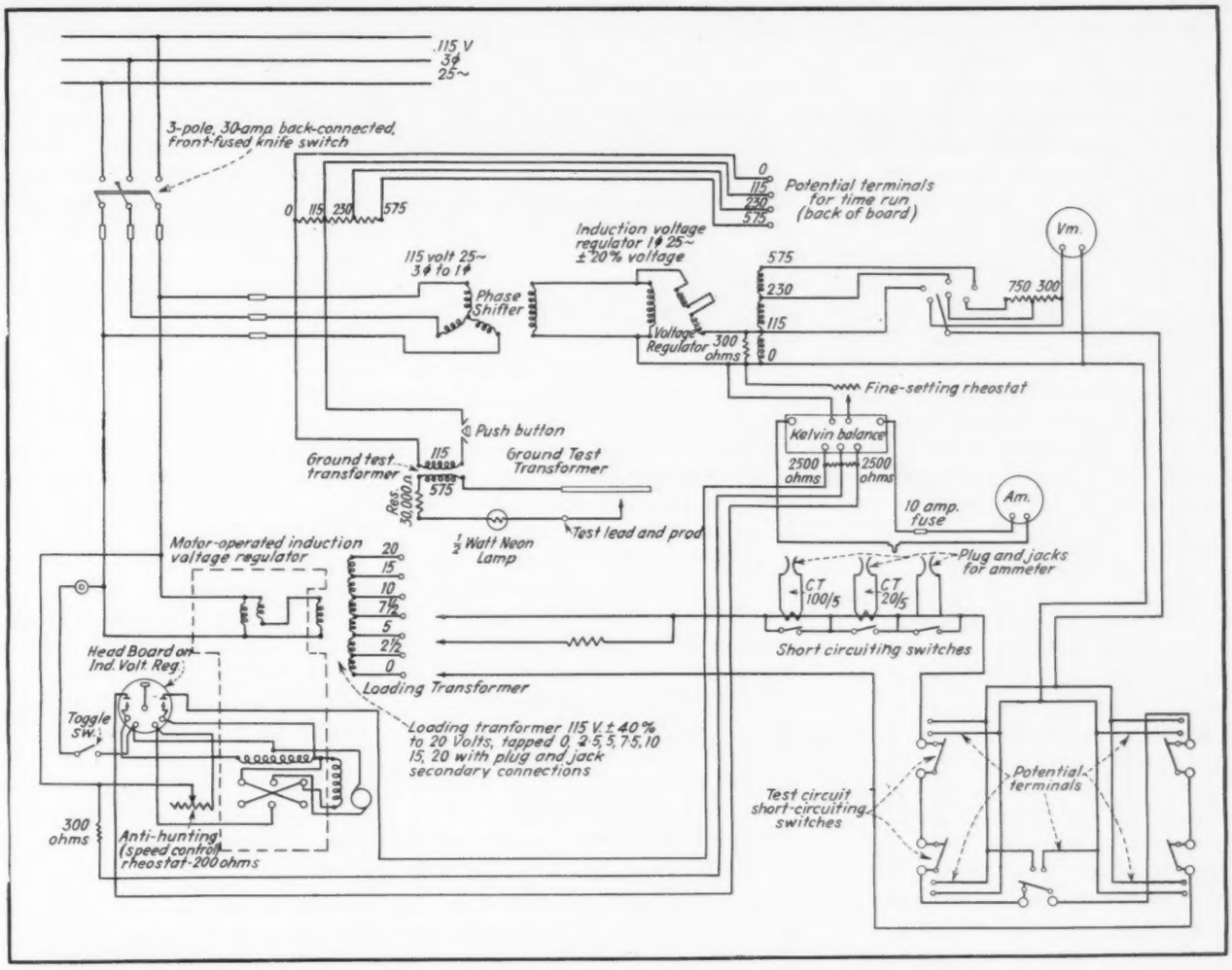
It should be noted that all meters in the Dominion of Canada before being installed upon consumers' premises must be submitted to the Department of Trade and Commerce for accuracy tests, and, if complying with their requirements, are sealed. This seal is legal for a period of six years, at the expiration of which time the meter must be resubmitted to the department for reverification. From this it will be noted that, should the seal be broken, the meter becomes illegal, and no adjustments, therefore, can be made on consumers' premises. Should adjustments be necessary, it must be returned to the meter department, adjusted and resubmitted to the inspector.

Tests applied by the inspection service require for polyphase demand meters a test on each element separately at approximately the 250 scale mark, together with a series test of both elements at approximately two-thirds full scale. These tests are carried out on the supply companies' premises where testing facilities are provided.



**METER BENCH TESTS** 48 thermal demand meters in one batch

The length over all of this bench is 12 ft.. and height 5 ft. 10 in. Control panel occupies a space of 3½ ft., leaving at each end a space about 4 ft. long and 2½ ft. high to accommodate meters. Bench top, of hardwood covered with linoleum, is 2 ft. 8 in. wide and 3 ft. from floor level. Frame is constructed throughout of steel channel and 1¼-in. pipe with special fittings. All controls are located within easy reach of an operator standing in front of the panel.




**SCHEMATIC DIAGRAM of thermal demand meter test bench**

Phantom loading in conjunction with regulator having range of 20 per cent buck or boost. Motor-operated induction regulator has a rating of 3 kva. with ± 40 per cent voltage range and serves the primary of the loading transformer in conjunction with limit and reversing switch. Loading transformer is tapped for 0, 2½, 5, 7½, 10, 15, 20 volts with plug and jack secondary connections. Ammeter is 0 to 7½ amp., also scaled for 0-30, 0-150 amp.

The time necessary to test the thermal meter has been an objection to its use, since it is not possible to make any check for accuracy other than applying load for a predetermined period, and, should any adjustment be required, allowing the pointer to settle back again before repeating the test.

In view of the many tests required, some method of reducing the testing time was desirable, and since the thermal type meters lend themselves readily to group testing, a test bench was built combining group testing with automatic load control.

Arrangement of the bench and equipment is shown in the accompanying illustration. Several objectives have been kept in mind. Ample space has been provided for testing meters in as large groups as are likely to be available, plus space for an equal number being prepared for test. The connections have been made completely flexible. Sufficient automatic control is provided to free the operator from the more tedious and unproductive phases of testing.

### *Meters Hung Uniquely*

Hangers are available for as many as 48 meters at one time if both sides of the rack are used. The scheme adopted for hanging meters on this rack is a feature making for great flexibility. Lengths of ½-in. rod are supported on studs inside the inverted channels. On these rods are threaded standard eyebolts on which special round nuts are soldered in position. The rods are at such a height that the eyebolts are supported in a horizontal position by either upturned edge of the channel. The nuts are small enough to pass through meter-mounting lugs and positioned to hold meters vertically against the rack. The eyebolts are free to slide to any position lengthwise and may be turned to either side of the rack.

On the panel are provided five pairs of current terminals with short-circuiting switches, two pairs at each side for meters under test and one pair at the bottom for a standard wattmeter. There are five pairs of potential terminals corresponding to the five for current.

A voltage selector switch connects 115, 230 or 575 volts to the potential terminals and at the same time connects the correct voltmeter multiplier in the circuit. Test voltage is set to the desired value by means of a hand-operated induction voltage regulator mounted under the bench top to the left of the panel. Since the regulator is wound for 20 per cent buck or boost, it has ample range for all routine testing.

Phantom loading is used entirely, consequently the current circuit is supplied by a transformer with a low-voltage secondary. The nominal primary voltage is 115 and the secondary is tapped for 2.5, 5.0, 7.5, 10, 15 and 20 volts. These taps are brought out to heavy-duty jacks mounted on a panel attached to the transformer. The current circuit of the bench can be connected to any pair of taps by means of plugs on flexible leads. Approximate adjustment of current is obtained by selection of taps and fine adjustment and control by a motor-operated induction regulator in the primary of the current transformer. The regulator is wound for 40 per cent buck or boost.

***Phase Shifter***

Control is entirely automatic. Connected permanently in the test circuits is a Kelvin balance type, contact-making wattmeter, which may be seen in the center of the panel. By means of weights on the moving element and a rheostat on the potential circuit the control instrument may be balanced for any desired load. Deviation from the correct value causes it to make contact, thereby through a relay operating a reversing motor on the regulator so as to restore balance. Once set, load is controlled without further attention. When starting a test the operator may set the timer, also mounted on the panel, which sounds an alarm signaling the end of the test period. By this means he is left free for other duties without danger of unduly prolonging the test.

Tests may be made at any power factor, lagging or leading. A phase shifter for 115-volt, three-phase input and 115-volt, single-phase output feeds into the auto-transformer and voltage regulator of the potential circuit. The potential applied to the meter is thereby completely adjustable as to magnitude and phase.

On the back of the panel a set of potential terminals connected to a separate auto-transformer makes available an independent source of 115, 230 and 575 volts. Meters of voltage other than those on load test can therefore be kept warmed up on potential.

Another separate circuit is provided for detection of grounds in any meters hanging on the racks. The indicating lamp, push-button and test lead terminal may be seen to the right of the two lower current terminals.

Two meters on the panel give indications of the current and voltage being used at any time. The voltmeter range is changed automatically by the voltage selector switch. The ammeter is 7.5 amp. full scale. For currents above this range two small current transformers 20/5 and 100/5 are used. The primaries, with their short-circuiting switches, are permanently connected in series in the current circuit. The ammeter circuit connects direct or into one of the transformer secondaries by means of a jack. The corresponding switch, one of the three just to the right of the Kelvin balance instrument, must then be opened to obtain an indication.

In practice, meters to be tested are placed on one side of the rack and those being prepared for test on the other, or if smaller quantities are involved the two sections of one side may be used alternately. At the beginning of each test the operator makes the necessary adjustments to the load control, and during the next half-hour may proceed to make preliminary adjustments on the next lot of meters. Immediately testing has been completed on one group, connections may be transferred to the next which have been held ready on potential, and new tests carried on while the completed meters are replaced with another group.

We test approximately 2,000 meters each year, but since all tests are repeated by the Department of Trade and Commerce the number of meters passed annually through the test tables is about 4,000.

The bench is not held up until 48 meters of a given capacity are accumulated, since this would involve carrying a large stock of meters to cover the various 5-, 10-, 25-, 50- and 100-amp. sizes. However, when new meters are required we include these with meters that have been brought in for reverification and thereby make up groups of reasonable size.

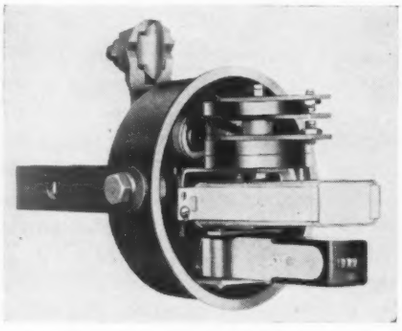
Chief drawback in testing the thermal meter is the time taken to warm the meter up to its operating condition and the necessity of applying potential for at least twelve hours before carrying out any tests. The bench is arranged to apply potentials of 115, 230 or 575 volts to different groups and thereby keep the bench operating.

## Arrester Discharge Counter Aids Operation

[*Continued from page 63*]

on line terminals are equipped with one counter in the common ground lead.

The installation illustrated is one of six which have totaled 37 discharge operations during the intensive part of the 1940 lightning season. This particular installation is of especial importance because old transformers are used in a station fed by a well shielded but highly insulated line having low ground resistance of structures and high ground wires which terminate in a network well elevated over the station. Since the line has tripped out only twice, most of the operations of the arrester arise from induced surges which must double in voltage at the end of the line in order to operate the arrester. No station failures have occurred.



General Electric arrester discharge counter (cover removed) comprises "Thyrite" disks, a capacitor and a counter mechanism

Arrester operations in 1940 for one-line, two-line and four-line, 66-kv. stations were:

| | Station | | |
|---|---|---|---|
| | One-Line | Two-Line | Four-Line |
| Total operations.... | 39 | 15 | 17 |
| Operations per line | 39 | 7.5 | 4.25 |

These data show the influence of the junction effect through which the terminal voltage varies according to the surge impedance encountered by the traveling wave striking the station. Virtually all of the arrester operations in two-line and four-line stations are correlated with line tripouts, while only two of the one-line operations are so correlated.

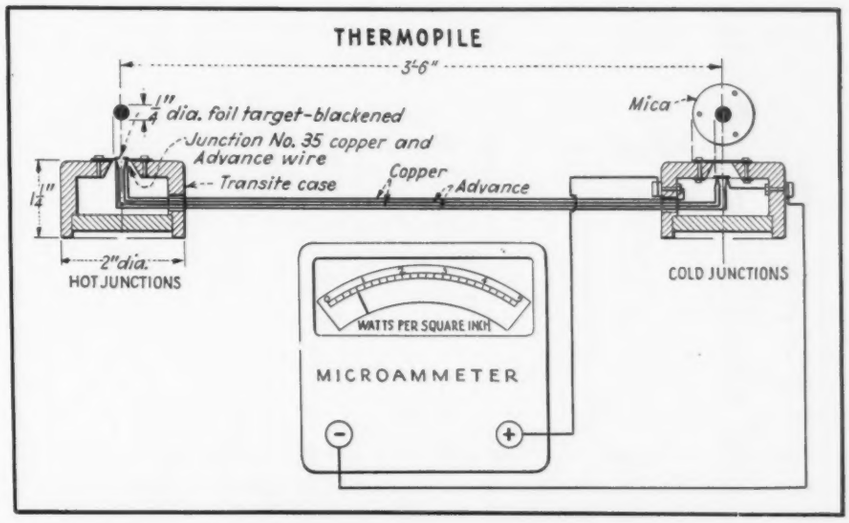
Experience indicates that the lightning arrester discharge counter furnishes data which are of value in research, operation and maintenance.

# Infra-Red Application Studies Develop New Guides

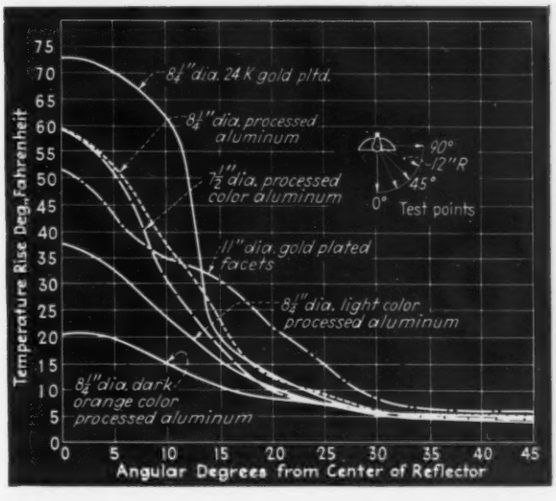
***Utilities Research Commission suggests energy concentration vs. time as basis for rating infra-red operations — Data on 60 installations and experiments — Recommendations on lamps, reflectors and heat concentrations***

APPLICATION of infra-red radiation to industrial process drying has, since its introduction about two years ago, been largely an empirical art. Utility power sales engineers and engineers in industry have been forced to approach new radiant heating application with a few sketchy general "rules of thumb" and work out the details on a cut-and-try basis.

To the end that the design of infra-red applications may be further removed from the field of experiment and proceed along more orderly engineering lines, the Utilities Research Commission* in 1939-40 undertook a study of this form of heating and how it should be applied. From this study have come some specific recommendations regarding (1) fields of operation most suitable for this drying process, (2) most suitable type size, finish and spacing of reflectors, (3) must suitable type and wattage of lamp, and (4) heat concentrations required for moisture drying and baking of industrial finishes.




**THERMOPILE DESIGN used in making measurements of radiant energy concentrations (watts per sq. in.) on materials under infra-red lamp banks**




**VARIATIONS for different types of infra-red reflectors of rise above room temperature produced on a thermopile a foot distant from the lamp filament. Lamp used was a Nalco 260-watt, 120-volt, "625 Dritherm" carbon filament**

Note: In interpreting curves, high temperatures in the 0 to 5 deg. and 0 to 10 deg. zones do not represent large amounts of energy as the zonal areas subtended by these angles are relatively small.

### *Energy-Time Rating*

Perhaps the most significant proposal resulting from the study is that all radiant drying operations be rated by energy concentration on the surface to be treated (measured in watts per sq.in.) and time in minutes rather than the temperature vs. time rating more frequently used. As an initial contribution to data on the energy concentration vs. time method of rating, the commission made available statistics for all of the installations sold by the Commonwealth Edison Company up to May, 1940, and also on experiments on a number of manufactured articles submitted to the company laboratory up to that time. These data appear in a table accompanying this article. It is believed that as more energy concentration data of this type accumulate unknown factors will be progressively eliminated and engineers will be able to use them to judge whether operations are suitable for lamp drying and determine just what energy con-

* An organization sponsored by the Commonwealth Edison group of companies in Chicago.

# RADIANT ENERGY HEATING INSTALLATIONS

# SOLD BY COMMONWEALTH EDISON COMPANY, CHICAGO

| | | DESCRIPTION OF MATERIAL TREATED | | | DESCRIPTION OF FINISH | RECOMMENDATIONS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE OF BUSINESS | OPERATION | WOOD, SHEET STEEL, IRON, ALUMINUM, PAPER, GRANULAR, ETC. | SIZE: WIDTH, LENGTH AND THICKNESS | PIECES PER HR | (PAINT, ENAMEL, LACQUER, SYNTHETIC UREA FORMALDEHYDE: ALSO PIGMENT, VEHICLE, COLOR, ETC. | NO. & SIZE OF LAMPS | TOTAL WATTS INSTALLED | REFLECTOR DIAMETER AND SPACING | REFLECTOR FINISH (GOLD OR ALZAK) | DISTANCE OF FILAMENT FROM WORK | TIME UNDER LAMPS | EXPECT DELIVERED WATTS/SQ.IN. ON WORK |
| PENCIL Manufacturer (Automatic) | Lacquer drying on pencils. | Wood pencil barrels. | 1/4" dia. x 5" long | 2500 | Colored synthetic lacquer - using 4 coats now - intend 6 coats. | 10 - 240W Carbon PS30 | 2400 | 8-1/4" dia. 14.4" spacing | Alzak | 12" and 16" | 1-1/2 min. | 1.80 & 1.40 |
| FOIL (Metal) on bond paper | Preheating embossing rolls. | Steel rolls for aluminum foil. | 24" long Approx. 5" dia. | - | None used. | 3 - 375W Carbon G30 | 1125 | 8-1/4" dia. | Alzak | 8" | 70 ft/min. Continuous speed | 2.0 |
| SIGNS (Glass Photographic Transparency) | Drying photographic film on glass. | Single strength clear crystal glass. | 10" x 12" avg | 4 | Photographic emulsion. | 6 - 260W Carbon G25 | 1560 | 6 lps in 24"x36" metal pan. | | 24" to 36" | 2 min. | 0.25 |
| DUPLICATING MACHINE manufacturer | Lacquer drying on cloth stencil. | Linen similar to tracing cloth roller-coated with the lacquer. | Continuous roll, 8" wide | Not Known | Details of lacquer not known. | 8 - 240W Carbon PS30 | 1920 | 8-1/4" dia. 8-1/2" spacing | Alzak | 12" | Not Known | 1.6 |
| CAMERAS (Movie) and Projection Equipment | Forming wrinkled finish on cameras and projectors. | Aluminum die-cast metal. | 2" x 4" x 6" | 50 | Synthetic plastic wrinkle finish sprayed on. | 4 - 250W Tungsten G30 | 1000 | 8-1/4" dia. 9-1/2" spacing | Alzak | 8" | 6 min. | 2.75 |
| CELLOPHANE, PLIOFILM and Paper Bags | Ink drying on cellophane and pliofilm bags. | - | - | - | Lacquer ink labels printed on bags. | 4 - 260W Carbon G25 | 1040 | None | None | Varied | Not Known | - |
| FIBER and PLASTIC Parts for Radios | Softening bakelite sheets for punching and shearing. | Thin bakelite sheets, black and tan colors, from which parts are stamped. | 2" to 24" x 36" up to 3/16" thick | 1000 | None - softening. | 6 - 260W Carbon G25 | 1560 | 8-1/4" dia. 8-1/2" spacing | Alzak | 12" to 24" | 3-1/2 sec. Cont. after 2 min.preht. | 0.9 |
| FIBER and PLASTIC Parts for Radios | Softening bakelite sheets for punching and shearing. | Thin bakelite sheets, black and tan colors, parts punched out. | 3" x 4' 1/8" thick | 1000 | None - softening. | 16 - 240W Carbon PS30 | 3840 | 8-1/4" dia. 8-1/2" spacing | Alzak | 12" to 24" | 3-1/2 sec. Cont. after 2 min.preht. | 0.9 |
| SOAP Manufacturers | Sealing and drying cardboard carton flaps. | Cardboard containers - boxes for soap flakes and powders. | 2" x 6" x 8" | 2700 | Glue on flaps of cardboard cartons. | 10 - 250W Tungsten G30 | 2500 | 8-1/4" dia. 8-1/2" spacing | Alzak | 8" | Continuous - 15 ft per min. | 2.75 |
| DUPLICATING Machines and STENCILS | Drying filler on fabric stencils | Cloth rolls impregnated with latex-like filler and lacquer. | Continuous roll, 36" wide | Not Known | See foregoing. | 56 - 260W Carbon G25 | 14560 | 7-1/2" dia. 7-1/2" spacing | Color Alumilited | 6" | Continuous - not determined. | 3.40 |
| ENVELOPE Manufacturer | Gumming and drying envelope flaps. | Paper mailing envelopes. | 6" x 8" Also various sizes | 2700 | Gum or mucilage; dextrine, glycerin, alcohol and water. | 8 - 260W Carbon G25 | 2080 | 7-1/2" dia. 7-1/2" spacing | Color Alumilited | 10" to 17" | Continuous - 5 ft per min. | 2.34 |
| CASKET Manufacturer | Drying out inside of metal caskets. | Sheet steel pressed and welded burial caskets. | 16" x 24" x 72" Approx. | Not Known | Plated or oxidized surfaces from which moisture must be removed on inside. | 10 - 260W Carbon G25 | 2600 | None - special arrangement. | None | 3" to 8" | 5 to 10 min. | 0.40 |
| CASKET Manufacturer | Drying glue in casket linings gumred to a scrim base. | Silk lining imitation quilting glued to heavy scrim base before installing. | In panels cut to size | Not Known | Moisture drying from glue. | 6 - 260W Carbon G25 | 1560 | 8-1/4" dia. 8-1/2" spacing | Alzak | 12" to 18" Avg 16" | 4 to 6 min. Refl.moved over wk. | 1.33 to 0.90 |
| RADIO and Parts Manufacturer | Softening bakelite tubes for punching. | Semi-hard bakelite (XX) | 3" dia. by 16" x 1/16" | Not Known | None - softening. | 8 - 240W Carbon PS30 | 1920 | 8-1/4" dia. 8-1/2" spacing | Alzak | 12" to 18" | Continuous after 2 min. preheat. | 1.2 |
| RADIO and Parts Manufacturer | Baking out radio coils and transformers. | Electrical coils and windings on fiber or bakelite cores. | 3" dia. x 2" long | Not Known | Insulating varnish impregnation. | 16 - 260W Carbon G25 | 4160 | 8-1/4" dia. 8-1/2" spacing | Alzak | 10" avg | 4 min. | 1.6 |
| TOY and GAME Manufacturers | Baking or drying water dye and lacquer inks on game pieces. | Wood dominoes, checkers and bottle tops. | 1" x 2" and 1" dia. 1/4" thick | Not Known | Water dyes and lacquer inks. | 36 - 240W Carbon PS30 | 9120 | 8-1/4" dia. 8-1/2" spacing | Alzak | 12" | 5 min. | 1.33 |
| STAMPINGS (Metal) | Enamel baking on small metal stampings. | Sheet metal display with pressed pocket for advertising. | 4" x 6" x 1/32" | Not Known | Red enamel sprayed on. | 16 - 260W Carbon G25 | 4160 | 8-1/4" dia. 8-1/2" spacing | Alzak | 12" | 12-15 min. | 1.33 |
| PAINT Manufacturers | Laboratory tests of enamels on steel sheet. | Sheet steel test samples. | 3" x 6" x 1/32" | Not Known | Paints and enamels afd by a Chicago paint house. | 4 - 250W Tungsten G30 | 1000 | 8-1/4" dia. Portable | Alzak | Varied | 4-8 min. | Varied |
| PAPER BAGS (Puffed Grains and Confections) | Sealing pliofilm bags. | Pliofilm bags to be put in cardboard boxes. | 2" x 6" x 8" | Not Known | None - Sealing by direct contact with lamp bulb. | 6 - 260W Carbon G25 | 1560 | None - bare lamps | None | Direct Contact | Instantaneous | - |
| PLASTIC Moldings | Dehydrating Tenite granules preparatory to molding. | Tenite (a plastic) granules in many shades and tints. | 1" thick in metal pans 22"x30"x3-1/2" | 50 lb | None - Moisture removed. | 24 - 260W Carbon G25 | 6240 | 7-1/2" dia. 7-1/2" spacing | Color Alumilited | 12" to 36" | 15-45 min. | 1.33 to 0.66 |
| PAINT Manufacturer | Laboratory tests of enamels on steel sheet. | Sheet steel test samples | 3" x 6" x 1/32" | Not Known | Paints and enamels. | 4 - 250W Tungsten G30 | 1000 | 10" dia. 10" spacing | Gold | Varied | 4-8 min. | - |
| INK Manufacturer | Drying one-color ink to go with press - experimental. | Continuous rolls of cellophane. | 8" wide | Not Known | Lacquer inks. | 4 - 260W Carbon G25 | 1040 | 7-1/2" dia. 7-1/2" spacing | Color Alumilited | 3" to 4" | Continuous - 90 ft per min. | 2.70 |
| CELLOPHANE and PAPER BAG Manufacturers | Drying inks on cellophane bags and wrappers. | Continuous rolls on 3-color press. | 12"-24" wide | Not Known | Lacquer printing inks. | 16 - 260W Carbon G25 | 4160 | 8-1/4" dia. 8-1/2" spacing | Alzak | 2" to 3" | Continuous - 120 ft per min. | - |
| PLASTIC Moldings | Dehydrating Tenite granules preparatory to molding. | Tenite (a plastic) granules in many shades and tints. | 1/2"-1" thick in metal pans | 50 lb | None - Moisture removal. | 8 - 260W Carbon G25 | 2080 | 7-1/2" dia. 7-1/2" spacing | Color Alumilited | 12" min. | 10-20 min. | 1.33 to 0.66 |
| PAINT Manufacturer | Laboratory Tests of enamels on steel sheet. | Sheet steel test samples. | 3" x 6" x 1/32" | Not Known | Paints and enamels. | 4 - 260W Carbon G25 | 1040 | 8-1/4" dia. Portable | Alzak | Varied | 4-8 min. | Varied |
| LIGHTING FIXTURE Manufacturer | Removing cyanide from pits and pores in castings. | Gray cast-iron. | 10"-14" dia. 1-1/2" x 2" height | Not Known | Plating after wash in cyanide and hot water. | 24 - 260W Carbon G25 | 6240 | 8-1/4" dia. 8-1/2" spacing | Alzak | 7" Varied | 20 min. | 3.2 |
| PRINTING - Advertising | Drying or setting ink on printing press. | Paper stock. | 26" x 41" avg | 4200 | Printing inks. | 4 - 260W Carbon G25 | 1040 | 8-1/4" dia. 8-1/2" spacing | Alzak | 16" | 1 sec. | 0.90 |
| CELLULOID Tab and Note Book Manufacturers | Softening celluloid for shearing. | Celluloid strips to be made into index tabs. | 1/2" stripe 1/32" thick | Not Known | No finish - softening. | 5 - 260W Carbon G25 | 1300 | 8-1/4" dia. 8-1/2" spacing | Alzak | 12" | 5 sec. | 1.33 |
| RADIO Speakers | Evaporating solvent from paper radio cones dipped in lacquer. | Black paper radio cones to be used on speakers. | 5" dia. 1" height | 1000 | Synthetic lacquer with solvent thinner. | 16 - 260W Carbon G25 | 4160 | 7-1/2" dia. 7-1/2" x 12" spacing | Color Alumilited | 4" | 2 min. Adjustable | 2.63 |
| PRINTERS | Drying inks on printed paper stock. | High-grade paper stock on 3-color press. | 40" wide | 1500 | Printers' ink with dryer - in addition, 3000 w in strip heaters are used. | 12 - 260W Carbon G25 | 3120 3000 | 10" dia. 10" spacing | Gold | 4" | 2-3 sec. | 3.4 |
| BAKELITE and Fiber Stampings | Softening bakelite strips for punching. | Bakelite strips from which small parts are punched by press. | 4" x 36" Up to 3/16" thick | Not Known | None - softening. | 8 - 260W Carbon G25 | 2080 | 7-1/2" dia. 7-1/2" spacing | Color Alumilited | 6" | Continuous after 2 min. preheat. | 2.43 |
| BAKELITE and Fiber Stampings | Softening bakelite strips and sheets for punching. | Bakelite strips from which small parts are punched by press. | 3' x 4' Up to 3/16" thick | Not Known | None - softening. | 12 - 260W Carbon G25 | 3120 | 7-1/2" dia. 7-1/2" spacing | Color Alumilited | 14" | Continuous after 2 min. preheat. | 2.00 |
| RADIO Transformers | Baking finish on transformer cases. | Pressed sheet steel boxes (22 gauge). | 3" x 3" x 4" | 120 | Black nitro-cellulose lacquer with solvent - 5 min. air dry, 10 min. under lamps, 10 min. air. | 30 - 260W Carbon G25 | 7800 | 10" dia. 12" spacing | Gold | 8" | 10 min. | 3.50 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RADIO Speakers | Drying adhesive lacquer or glue on speaker cones. | Steel frame and paper cones. | 6" dia. cones 3" high speaker | Not Known | Nitro-cellulose adhesive lacquer. | 66 - 250W Carbon G25 | 22660 | 7-1/2"& 9-1/4"dia. 7-1/2"& 9-1/4"spacing | Gold & Color Alumilited | 8" | Continuous - 2 ft per min. | 2.40 |
| TIN CAN Manufacturer | Laboratory use - baking finishes on cans. | Tin cans, labels and decoration printed directly on tin. | 2"-3" dia. 4"-5" height | Not Known | Enamels, lacquers, inks. | 3 - 250W Carbon G25 | 760 | 9-1/4" dia. 9-1/4" spacing | Gold | Not Known | Laboratory use | Varied |
| PISTONS - Gas Engine and Tractor Manufacturer | Expanding pistons to permit dropping pins in place. | Aluminum alloy pistons. | 4"-5½ dia. 6" height | Not Known | None - Expanding metal operation. | 4 - 250W Carbon G25 | 1040 | 7-1/2" dia. 7-1/2" spacing | Color Alumilited | 6" | 3 min. | 2.85 |
| FIBER and BAKELITE Electrical Parts | Softening bakelite for punching and shearing. | Bakelite strips from which small parts are punched by press. | 2"-3" x 48" | Not Known | None - softening. | 16 - 250W Carbon G25 | 4160 | 7-1/2" dia. 7-1/2" spacing | Color Alumilited | 14" | Continuous after 2 min. preheat. | 1.16 |
| CELLOPHANE and PAPER BAG Manufacturers | Drying or setting inks on cellophane bags. | Cellophane bags and wrappers. | 2"-8" x 4"-10" | 3000 | Lacquer printing inks. | 4 - 250W Carbon G25 | 1040 | 7-1/2" dia. 7-1/2" spacing | Color Alumilited | 5" | 1-1-1/2 sec. | 2.42 |
| JEWELRY (Novelty) Manufacturer | Drying paste to hold jewels in place. | Plated brass and die cast metal. | 1/2"-1" dia. 1/16" thick | Not Known | Jewelers' paste. | 2 - 250W Carbon G25 | 520 | None - in enclosure. | None | Not Known | 5 min. | Enclosed |
| VALVE Manufacturers | Baking enamel finish on globe valves. | Cast or wrought iron and brass. | Up to 1-1/2" valves | Not Known | Green air dry enamel. | 8 - 250W Carbon G25 | 2080 | 8-1/4" dia. 8-1/2" spacing | Alzak | 6-8" | 5 min. | 2.75 |

# FIELD AND LABORATORY TESTS BY COMPANY TESTING DEPARTMENT

| | | | DESCRIPTION OF MATERIAL HEATED | | | DESCRIPTION OF FINISH | DESCRIPTION OF TEST | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPE OF BUSINESS | OPERATION | SUCCESSFUL? (YES OR NO) | WOOD, SHEET STEEL, IRON, ALUMINUM, PAPER, GRANULAR, ETC. | SIZE: WIDTH, LENGTH AND THICKNESS | FORMER TIME REQUIRED | (PAINT, ENAMEL, LACQUER, SYNTHETIC, UREA FORMALDEHYDE; ALSO PIGMENT, VEHICLE, COLOR, ETC.) | NO. & SIZE OF LAMPS | TOTAL WATTS INSTALLED | REFLECTOR DIA. AND SPACING | REFLECTOR FINISH | DISTANCE OF FILAMENT FROM WORK | TIME UNDER LAMPS | ENERGY DELIVERED WATTS PER SQ.IN. ON WORK |
| CHINA-and CROCKERY Manufacturer. | Drying protective mask on dishes preparatory to acid etch. | Favorable Hardening | Small white china saucers in the glaze of which flower and other designs are to be etched. | 4-1/2" dia. by 3/32" thick | 10 hr | Wax-like masking material containing oils, volatiles and beeswax which will not stand over 140 deg F without running. | 4 - 250W Carbon G25 | 1040 at ½-Voltage | 8-1/4" diameter 8-1/2" spacing | Alzak | 12" | 1-3/4 hr Longer time req'd | 0.44 |
| WOOD RADIO CABINET Manufacturer. | Baking 3 coats, filler, sealer and finish, on hardwood panels. | Yes | Hardwood plywood, walnut and mahogany test panels. | 3" x 6" x 1/4" thick | 24 hr | Filler, sealer and finish coat. Each coat must be baked before applying next. | 4 - 250W Carbon G25 | 1040 | 8-1/4" diameter 8-1/2" spacing | Alzak | 12"-36" | 45 min. | 1.33 for filler 0.66 for finish |
| FINISHERS and Platers. | Baking wrinkled finish on die-cast auto heater cases or frames. | Yes | Die-cast frame or case for auto hot water heater. | 10"-12" dia. 4-1/2" height | 45 min. | Wrinkled finish enamel - grayish tan color - wrinkle formed in 5 minutes. | 32 - 250W Carbon G25 | 8320 | 8-1/4" diameter 8-1/2" spacing | Alzak | 10"-12" | 9 min. | 3.7 |
| FINISHERS and Platers. | Baking enamel on molded bakelite radio cabinets. | Yes | Small portable radio cabinet of molded bakelite - mottled brown color. | 6" x 8" x 14" 1/8"-1/2" thick | 45 min. | Urea formaldehyde baking enamel (220°F), cream color. | 32 - 250W Carbon G25 | 8320 | 8-1/4" diameter 8-1/2" spacing | Alzak | 8"-12" | 9 min. | 3.7 |
| PLYWOOD Manufacturers. | Drying out thin plywood sheets preparatory to making drums. | Yes | Two-ply flat gumwood - casein glue adhesive. | 18" x 36" x 1/8" thick | 12-24 hr | Moisture content reduced from over 25% to 15%. | 16 - 250W Carbon G25 | 4160 | 8-1/4" diameter 8-1/2" spacing | Alzak | 6" | 7-1/2 min. | 3.2 |
| PLYWOOD Manufacturers. | Drying out thin plywood sheets preparatory to making drums. | Yes | Three-ply flat gumwood - casein glue adhesive. | 14-1/2" x 30" x 3/16" thick | 12-24 hr | Moisture content reduced from over 25% to 15%. | 16 - 250W Carbon G25 | 4160 | 8-1/4" diameter 8-1/2" spacing | Alzak | 6" | 14 min. | 3.2 |
| ELASTIC BELT and Suspender Manufacturer. | Adhesion of Elasti-Glass, a flexible synthetic plastic. | No | Thin strips of rubber-like material translucent blue color. | 3" wide continuous 3/64" thick | Not Known | No finish - Attempt to cause adhesion of two strips by heating and softening. | 1 - 250W Carbon G25 | 250 | 8-1/4" diameter | Alzak | 2"-3" | 1/2 min. | Above 6.0 |
| METAL FURNITURE Manufacturer. | Baking out synthetic urea formaldehyde enamel on metal. | Yes | Test samples of steel sheet. | 3" x 6" (18 gauge) | 1 hr | Synthetic enamel, urea formaldehyde, air-dry enamel - Chinawood, soya and melelc oils. | 8 - 250W Carbon G25 | 2080 | 8-1/4" diameter 8-1/2" spacing | Alzak | 12" | 7 min. | 1.8 |
| PLYWOOD and PRESDWOOD Panel Makers. | Baking out synthetic enamel on Masonite panels. | Yes | Hard-surface Masonite. | 12" x 12" x 1/4" | 1 hr | Black vitralyn synthetic enamel. | 8 - 250W Carbon G25 | 2080 | 8-1/4" diameter 8-1/2" spacing | Alzak | 12" | 7 min. | 1.8 |
| LITHOGRAPH Finishers. | Drying spirit varnish or lacquer on lithographs. | Yes | Lithograph, pictures on cardboard stock. | 9" x 11-1/2" x 1/16" | 2 min. | Varnish chips in 30% alcohol; also transparent lacquers. | 8 - 250W Carbon G25 | 2080 | 7-1/2" diameter 7-1/2" spacing | Color Alumilited | 7" | 1 min. | 2.5 |
| RUBBER BALLOON Manufacturer. | Drying Latex on balloon forms. | No | Latex or liquid rubber. | 1/2" x 6" to 24" | 4 min. | No finish - forms immersed in Latex and dried or set by heat. | 11 - 250W Carbon G25 | 2860 | 8-1/4" diameter 8-1/2" spacing | Alzak | 4" | 55 min. | Above 3.0 |
| LAMINATED FOIL and Paper Sheet Manufacturer. | Drying paste and lacquer on foil sheets. | Yes | Aluminum foil on paper backing. | 12"-24" rolls 0.0005" thick | 200'/min. | Colored lacquers on surface - paste or gum between paper and foil. | 8 - 250W Carbon G25 | 2080 | 8-1/4" diameter 8-1/2" spacing | Alzak | 4" | Continuous 200 ft per min. | Above 3.0 |
| PRINTING INK Manufacturer. | Drying ink on paper stock. | Yes | White glazed paper stock. | 4" x 8" strips | Not Known | Black lacquer inks - 4% linseed only. | 1 - 250W Carbon G25 | 250 | 8-1/4" diameter | Alzak | 2" | 3 sec. | Above 6.0 |
| LAMINATED FOIL and Paper Sheet Manufacturer. | Drying aluminum foil after coating of color lacquer. | Yes | Aluminum foil on paper backing | 26"-38" rolls Foil .0004"-.0005" | 210'/min. | Colored lacquers on surface - 90% alcohol, shellac and dye color. | 40 - 250W Carbon G25 | 10400 | 8-1/4" diameter 8-1/2" spacing | Alzak | 7" | Continuous 210 ft per min. | 4.0 |
| VITREOUS ENAMELERS. | Drying ground coat preparatory to firing on at high temperature. | Yes | Steel sheet | 12" x 12" 20 gauge | Not Known | Water solvent ground coat gray color. | 24 - 250W Carbon G25 | 6240 | 8-1/4" diameter 8-1/2" spacing | Alzak | 10" | 9 min. | 2.6 |
| VITREOUS ENAMELERS. | Drying first finish coat on fired ground coat. | Yes | Steel pan with vitreous ground coat fired on. | 7" x 15 x 4-1/2" deep - 20 gauge | Not Known | Water solvent white first finish coat. | 24 - 250W Carbon G25 | 6240 | 8-1/4" diameter 8-1/2" spacing | Alzak | 10" | 5 min. | 2.6 |
| HAND TOOL Manufacturers. | Baking synthetic enamels on small axe blades. | Yes | Steel axe blades. | 3" x 5-3/4" Blade edge to 3/4" | 45 min. to ½ hr | Gloss black synthetic enamel and thinner. | 8 - 250W Carbon G25 | 2080 | 8-1/4" diameter 8-1/2" spacing | Alzak | 12" | 15 min. | 2.2 |
| PLASTIC Moldings. | Dehydrating or drying Tenite preparatory to molding. | Yes | Tenite (a plastic) granules, various grades and colors. | 1" layer in pan 22-1/2" x 30" x 5½" | Not Known | No finish - moisture removal. | 8 - 250W Carbon G25 | 2080 | 8-1/4" diameter 8-1/2" spacing | Alzak | 30" | 20 min. | 0.8 |
| PAINT Manufacturers. | Baking out synthetic enamels on steel sheet. | Yes | Steel test strips degreased and cleaned. | 3" x 6" - 20 gauge | 30 min. to 1 hr | Urea formaldehyde synthetic industrial finishes, enamels. | 32 - 250W Carbon G25 | 8320 | 8-1/4" diameter 8-1/2" spacing | Alzak | 10"-12" | 4-8 min. | 3.7 |
| ABRASIVE Manufacturers | Dehydrating or drying grain abrasives. | No | Aluminum oxide grains. | 1 lb. 1/4" to 1/2" thick layer | 2½ - 3½ lb./min. | No finish - moisture removal. | 32 - 250W Carbon G25 | 8320 | 8-1/4" diameter 8-1/2" spacing | Alzak | 10"-12" | 20 min. | 3.7 |

## Radiant Energy Concentration Resulting from Various Reflector Heights and Spacings

(Thermopile target exposure time in all cases — 30 seconds)

| Filament Height Above Work, Inches | Lamp Spacing, Inches | No. of Lamp Bars | No. of Lamps per Bar | Total No. of Lamps* | Average Reading in Micro-amperes | Avg. Watts per Sq. In. | Comments |
|---|---|---|---|---|---|---|---|
| 6 | 8¼ x 8¼ | 2 | 4 | 8 | 6.65 | 3.00 | Staggered reflectors. All in 1 plane above the work. |
| | | 3 | 4 | 12 | 7.21 | 3.25 | |
| | | 4 | 4 | 16 | 7.61 | 3.40 | |
| 12 | 8¼ x 8¼ | 2 | 4 | 8 | 5.20 | 2.34 | Staggered reflectors. All in 1 plane above the work. |
| | | 3 | 4 | 12 | 5.90 | 2.65 | |
| | | 4 | 4 | 16 | 6.20 | 2.79 | |
| 18 | 8¼ x 8¼ | 2 | 4 | 8 | 3.82 | 1.72 | Staggered reflectors. All in 1 plane above the work. |
| | | 3 | 4 | 12 | 4.42 | 2.00 | |
| | | 4 | 4 | 16 | 4.85 | 2.18 | |
| 6 | 8¼ x 8¼ | 2 | 4 | 8 | 6.37 | 2.87 | Oppositely positioned reflectors. All in 1 plane above work. |
| | | 3 | 4 | 12 | 6.51 | 2.93 | |
| | | 4 | 4 | 16 | 6.80 | 3.06 | |
| 12 | 8¼ x 8¼ | 1 | 4 | 4 | 2.96 | 1.33 | Oppositely positioned reflectors . All in 1 plane above work. |
| | | 2 | 4 | 8 | 4.07 | 1.83 | |
| | | 3 | 4 | 12 | 4.85 | 2.18 | |
| | | 4 | 4 | 16 | 5.05 | 2.27 | |
| 18 | 8¼ x 8¼ | 1 | 4 | 4 | 2.07 | 0.90 | Oppositely positioned reflectors. All in 1 plane above work. |
| | | 2 | 4 | 8 | 3.33 | 1.50 | |
| | | 3 | 4 | 12 | 4.06 | 1.80 | |
| | | 4 | 4 | 16 | 4.40 | 2.00 | |

* Lamp used, 260-watt, 120-volt carbon filament drying lamp.

centration and time are required, the number and size of lamps, space required and the cost of the installation, without constant repetition of tests.

Heretofore, industrial process drying in ovens, whether gas, electric or steam, has been regulated according to temperature and time. This has been quite satisfactory in the case of ovens, since objects in the ovens may be presumed to be at the same temperature as the air in the oven which the pyrometer measures. Also, the temperature of the object while in the oven is, in general, constant.

In the case of the radiant drying technique, the commission points out, the temperature of the object is never the same as the temperature of the air which a pyrometer might measure. Furthermore, the temperature in the treated object rises very rapidly throughout the interval of exposure, and is not constant. It is true that in some cases a ratio might be established between temperature of air surrounding the object and the temperature of the object itself in a radiant drying tunnel. This will vary, however, for every type, thickness and contour of object and could be quite difficult of determination.

### *Design Thermopile*

Energy concentration, on the other hand, can be measured readily at the surface of the object being heated by means of a thermopile of the type illustrated. Such an instrument will measure energy concentration in watts per sq.in. produced by any type of lamps, lamp spacing, reflector type distance from the work, etc., so that given the time-energy baking schedule, a tunnel and conveyor may be designed to produce the desired result.

The thermopile used in the commission investigations, shown schematically, consisted of two inclosures turned from "Transite"; one for the two-hot and the other for the two-cold junctions of the thermopile. All junctions are in series. Separating these inclosures is 3½ ft. of protective tubing containing the No. 35 copper and advance wires connecting the junctions. In the top of each inclosure is a ¼-in. diameter blackened foil target divided in two halves. Each half is connected to an individual junction and the two are mounted on a micarta disk attached to the top of the inclosure. In operation, the hot junction target is exposed to the radiation and the cold one is shielded so that it will be at room temperature. The electrical potential created between the two targets (hot

## Lamps Available for Finish Curing and Moisture Drying, 4-1-40

| Type | Volts | Watts | Bulb | Bulb Diam., Inches | Light Center Dist., In. | Over-all Length, Inches | Base | Filament Form | Color Temp. Deg. K. | Hours Life | List Price 4-1-40 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Carbon filament vacuum lamp | 110–120 | 240 | PS30 | 3¾ | 4½ | 6½ | Med. Screw Skirted | Hairpin Coil | 2,000 | 5,000 | $0.75 |
| Carbon filament vacuum lamp | 110–120 | 260 | G25 | 3⅛ | 4⅛ | 5⅛ | Med. Screw Skirted | Hairpin Coil | 2,000 | 1,500 | $0.75 |
| Carbon filament vacuum lamp | 110–120 | 375 | G30 | 3¾ | 4 | 5¾ | Med. Screw Skirted | Hairpin Coil | 2,000 | 1,500 | $1.50 |
| Tungsten filament gas-filled lamp | 105–120 | 250 | PS30 | 3¾ | 6 | 8 1/16 | Med. Screw | C–9 | 2,500 | 10,000 to 20,000 | $0.85 |
| Tungsten filament gas-filled lamp | 105–120 | 250 | G30 | 3¾ | 4 | 6⅛ | Med. Screw | C–7A | 2,500 | 10,000 to 20,000 | $1.00 |
| Tungsten filament gas-filled lamp | 105–120 | 250 | G30 | 3¾ | 4½ | 6½ | Med. Screw | C–11 Triangular Concentrating | 2,500 | 10,000 to 20,000 | $1.50 |
| Tungsten filament gas-filled lamp | 105–120 | 250 | R40 | 5 | Focusing | 6½ | Med. Screw | C–9 | 2,500 | 10,000 to 20,000 | $1.75 |
| Tungsten filament gas-filled lamp | 105–120 | 500 | G40 | 5 | 3½ | 7¼ | Medium Bi-Post | C–11 Triangular Concentrating | 2,500 | 10,000 to 20,000 | $6.00 |
| Tungsten filament gas-filled lamp | 105–120 | 1,000 | G40 | 5 | 3½ | 7¼ | Medium Bi-Post | C–11 Triangular Concentrating | 2,500 | 10,000 to 20,000 | $8.50 |

and cold) is proportional to applied energy. The resulting circuit current is measured by a microammeter calibrated to read directly in watts per sq.in.

To calibrate the thermopile a light source of known radiant energy output is selected. (In this case both a 1,000-watt and a 2,000-watt incandescent lamp bulb were used. Radiant energy of these lamps was known to be 90 per cent of watts input.

To secure watts per sq.in. as related to meter readings, the total watts energy input (with 10 per cent loss deducted) was apportioned to various zones of a unit sphere about the lamp, according to the microammeter readings and the zonal areas of the sphere. For each zone of a given sphere, namely of 6, 8 and 12 in. radius, the zonal area in sq.in. (for 5 deg. zones) was divided into the watts energy apportioned to that zone. Thus, meter readings multiplied by a constant so determined gave energy concentration in watts per sq.in.

### *Infra-Red Reflectors*

Early in the study the relative energy output of various types of reflectors and reflector surfaces then in general use was investigated by the commission. Output or efficiency of the reflectors was obtained by measuring the temperature rise at a given distance (1 ft.) radially from the lamp and at successive intervals of 5 degrees out from the axis of the lamp and reflector, using a 260-watt carbon filament lamp operating at 2,000 deg. Kelvin. Curves obtained are shown. These temperature rises were then converted into zonal energy or what might be called the utilization value of each available reflector shown in the accompanying chart.

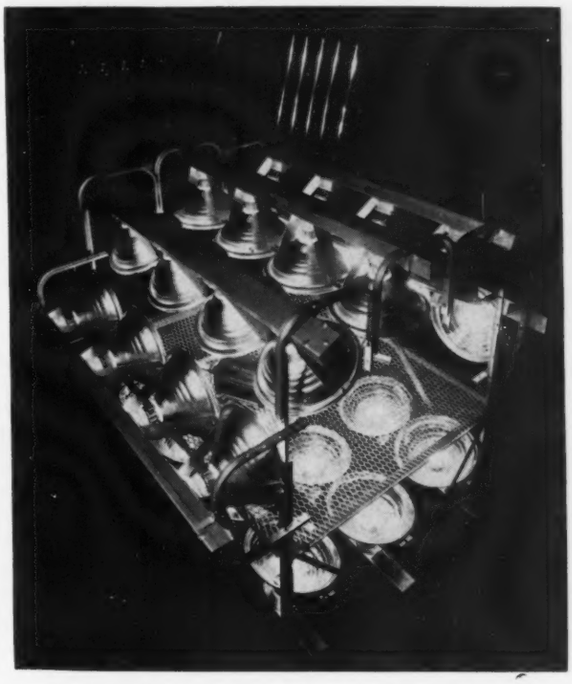
To evaluate the difference between processed aluminum and gold more closely, two identical reflectors and lamps were taken and the temperature rise obtained by a thermopile at a distance of 12 in. from the filament and at a number of positions so as to include a solid angle up to 60 deg.

It was found that in the zone 0-45 deg. the gold reflector showed a utilization of 61.3 per cent of the total energy of the lamp with reflector, whereas the same unit with processed aluminum finish showed a utilization of 55 per cent. In the 0-60 deg. zone the gold reflector showed a utilization of 77.3 per cent and processed aluminum 70.5 per cent.

### *Infra-Red Lamps*

Several types and sizes of lamps are available for infra-red application, as shown in the accompanying table. The commission found that the short light-center length lamps make for a more compact and better appearing tunnel. The 500- and 1,000-watt lamps are desirable where very high concentrations of energy are desired, but experience, according to the commission, is that relatively few are needed. Exceptions to this may be delivery ends of printing presses or applications where extremely high-speed drying is necessary.

Carbon lamps exhibit a decided tendency to blacken. Blackening is pronounced after 100 hours burning. Tests of *visible* energy radiation show 40 to 60 per cent loss due to this blackening. However, it does not follow that there is this loss in the invisible portion of the lamp's output, since a property of infra-red radiation is that it will penetrate opaque films, whereas visible light will not. The selection of reflectors for a particular application would be determined by a consideration of maintaining output over a period of time. This would depend on the frequency of cleaning required.



**INFRA-RED baking tunnel developed by Chicago research agency is built around four-lamp "light bar" as basic element**

### *Lacquers and Enamels*

Both enamels and lacquers are suitable for radiant drying, the report stated. However, the borderline between enamels and lacquers is not a definite one. In general, an enamel might be defined as a highly pigmented paint containing synthetic or natural gums and resins; also containing oils, driers, plasticizers and thinners. A lacquer is a more simple composition, being essentially a low-pigmented paint containing nitrocarbons, plasticizers and having a content of aromatic hydrocarbon solvents. Natural resins entering into enamels and lacquers are not as suitable as synthetic resins. It has come to be recognized that the more or less ideal finish would be a synthetic enamel with an appreciable urea formaldehyde content.

Lacquers ordinarily dry in air in a period of from fifteen minutes to one hour (free from tack) and in two hours (hard), whereas enamels require from four to six hours to dry and from eight to twelve hours hard. Enamels dry by polymerization, a chemical change or hardening of the resin, which is furthered by the use of urea formaldehyde. Lacquers dry almost wholly by evaporation of the solvents. Care must be used not to overheat the lacquer, causing bubbles or pinholes. While enamel may stand quite high energy concentrations, lacquers should be confined to relatively low values. In general, lamp drying of lacquers and enamels requires only from two to fifteen minutes, depending on the energy concentration. This is in comparison with typical allowance of one to four hours in an oven.

[*Continued on page 142*]

# Safety Precautions Feature Mine Distribution

*Besides taking customary precautions in handling high voltage, Tecumseh Coal Corporation reflects the trend by providing more and greater safety for men working in pit and around shovels at new strip mine near Dickeysville, Ind.*

*F. B. JANEWAY,* Tecumseh Coal Corp., and W. D. DRUMMOND,† Westinghouse Electric & Mfg. Co.*

1 PIT SUBSTATION is supplied over 33-kv. pole line from Southern Indiana Gas & Electric substation. Voltage is stepped down from 33-kv. delta to 4,150-volt wye through 2,500-kva., three-phase transformer bank. On 4,150-volt side of transformer bank feeding main pole line to shovels is a Westinghouse outdoor switch-house in which is a 100,000-kva. rectox-solenoid-operated oil circuit breaker equipped with automatic reclosing relay equipment to provide for three reclosures of the breaker before locking out.

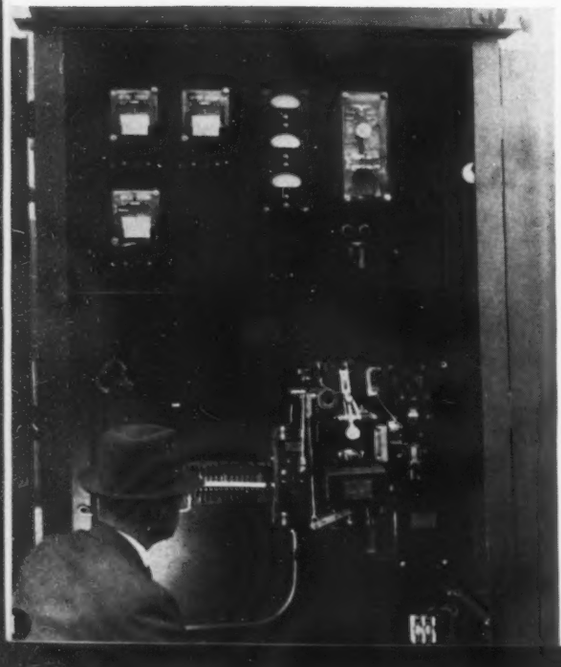
WOOD-POLE LINE carries energy from pit substation at 4,150 volts, three-phase, grounded neutral. In order to carry the load most economically two three-phase circuits, each consisting of three No. 1/0 phase wires, are carried on the poles, together with one No. 1/0 ground wire for the two circuits which are tied together at pit substation to operate in parallel. Each lateral pole line consists of three No. 2/0 phase wires and one No. 2/0 ground wire and may be disconnected from the main pole line by a set of outdoor, hook-stick-operated disconnecting switches. Ground wires of main and lateral pole lines are grounded at every sixth pole with ½-in. diameter, 8-ft. long ground rod. Lightning arresters are installed at both ends of main pole line and at ends of six laterals.

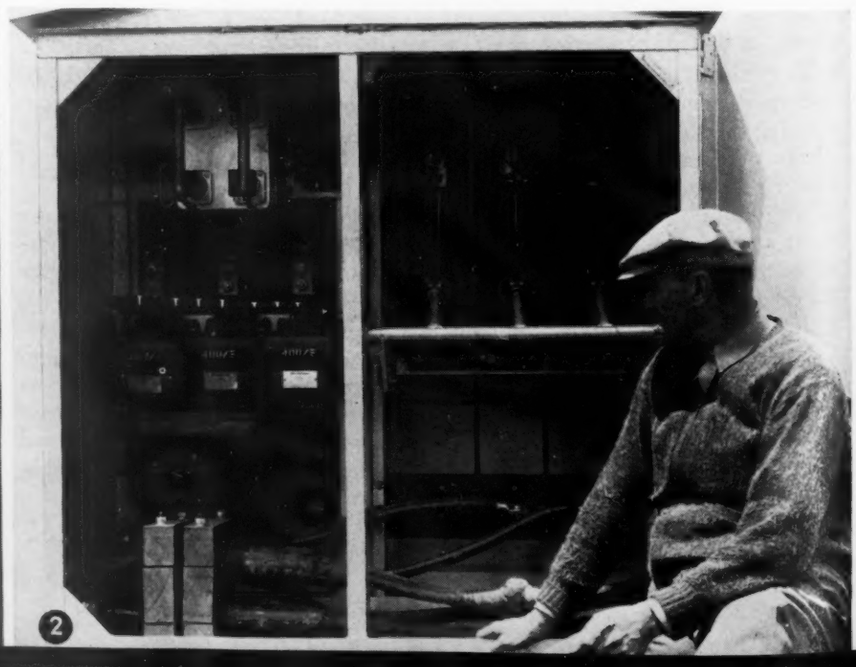
2 PORTABLE SWITCH-HOUSES are used in the field for the control and protection of the 4,150-volt feeder circuits from pole line to stripping and loading shovels. Three of these switch-houses are used, but only two at a time. One is connected to the stripper and one to the loader, while the third is moved ahead of the stripper. When the stripper reaches the end of its trail cable the cable can be quickly connected to the newly located switch-house and the process repeated. In each house is a group-operated, three-pole, single-throw disconnecting switch connected on the line side of a 600-amp., 7,500-volt, manually operated, 25,000-kva. rupturing capacity oil circuit breaker. Breaker is equipped with three 5-amp. instantaneous trip coils for overload protection. All copper connections are insulated and insulating barriers are provided between blades of disconnecting switches.

3 GROUND RELAY, high-speed, low-energy type, is mounted on steel panel in each house and used in conjunction with a.c. shunt trip coil to trip oil breaker in switch-house ahead of main oil circuit breaker in pit substaton. Since most trouble is expected to occur between portable house and shovel, ground relay in switch-house is set to trip instantaneously as added precaution. Remote metering equipment, which may be added on space left on the steel panel, would provide a continuous record of operations of stripper and loader on graphic meters in the office of the mine superintendent.

4 CABLES connecting portable switch-house to 4,150-volt line and to shovels are type SH class D 5,000-volt, three-conductor, shielded against corona. Cable from switch-house to power line

*Chief electrician. †Switchgear department.





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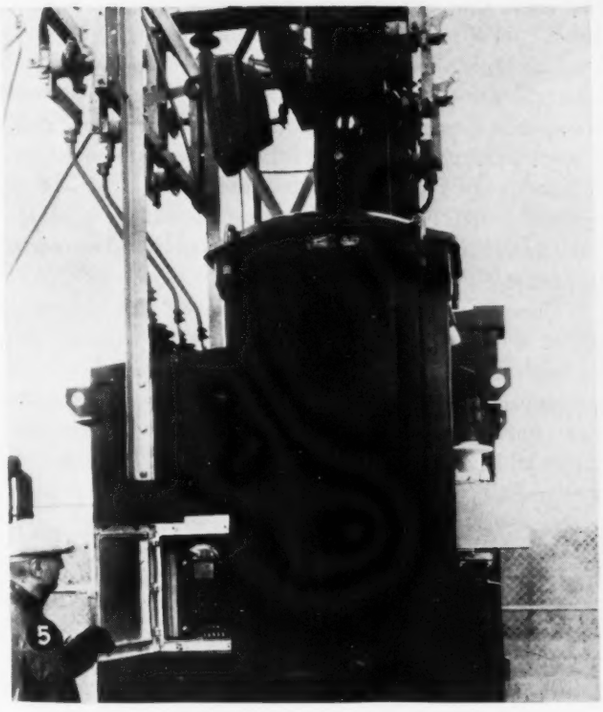
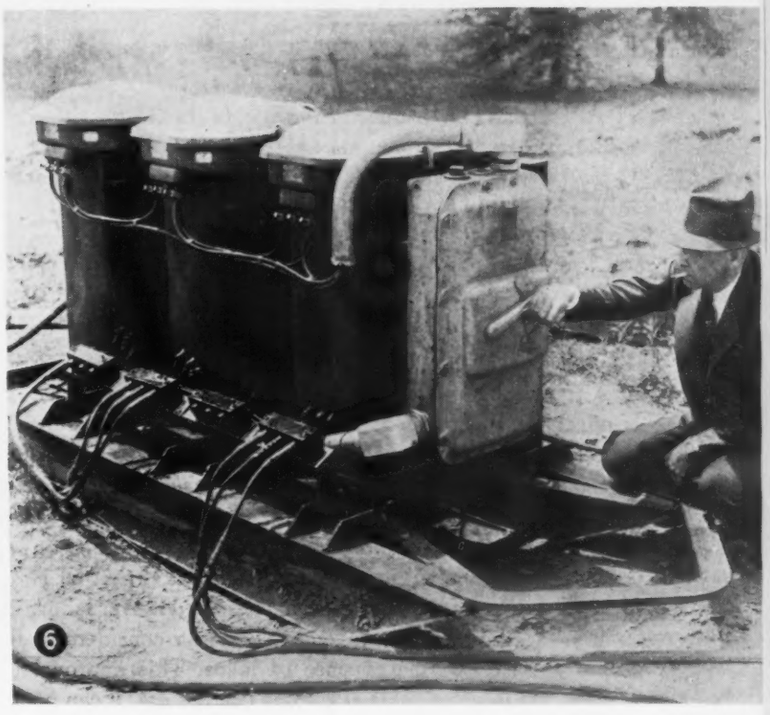




is permanently connected to portable house; live-line clamps connect cable to power line. This cable is 50 ft. long and consists of three No. 2/0, 259-strand wire, phase conductors and three No. 6 49-strand ground wires. Trail cable from loader is 1,000 ft. long and consists of three No. 6, 49-strand phase wires and three No. 12, seven-strand ground wires. Three Miller single-pole receptacles and one signle-pole plug are located inside the house for connecting trail cable from shovel. There is a plug on the end of each of the phase wires of the trail cable since receptacles, when disconnected, would become clogged with dirt as they are dragged along the ground. However, a receptacle is used on the ground wire of trail cable so it cannot be accidentally connected to phase wire. Ground wires of cable are connected to shielding of phase wires, then all ground wires are connected together and finally grounded on metal frame of switch-house and shovel.

5 REACTOR in the grounded neutral of the star-connected secondaries of the 2,500-kva. transformer bank limits potential from frame of shovels to about 100 volts in case of grounded phase cable or motor. Reactor is rated 50-amp. continuous, 2,400-volt, 60-cycle, 133-kva., single-phase and is of the oil-immersed outdoor type. Between reactor and grounded point of transformer neutral is a 50/5-amp. outdoor type current transformer having its secondary connected to a low-energy ground relay, which, with its testing switch, is mounted in a weatherproof cabinet on side of switch-house. Relay has current range of $\frac{1}{2}$ to $2\frac{1}{2}$ amp. and is set to trip oil breaker in switch-house in $4\frac{1}{2}$ seconds when current in grounded neutral circuit exceeds 25 amp.

6 PORTABLE SLEDS furnish energy to the auxiliary equipment in the pit. Mounted on each of the two sleds is a Westinghouse 75-kva., three-phase, 4,150/480-240-volt, 60-cycle transformer bank protected on the primary side by 5,000-volt fuse cutouts and on the secondary side by a type AB "De-ion" air circuit breaker inclosed in an outdoor weatherproof cabinet. Transformers are connected to 4,150-volt pole line by live-line clamps on end of 50-ft. length of No. 6, 5,000-volt, type SH class D conductor cable with three ground wires. Low-voltage circuit is divided into four outgoing feeders, all equipped with Miller single-pole sockets mounted on sled for receiving cable from pit auxiliaries.

# Editorials

S. B. WILLIAMS, *Editor*

## *Labor Building Up Public Ill Will*

IT APPARENTLY is difficult for man to stand prosperity. Labor is demonstrating this axiom at the present time. Backed for eight years by a sympathetic administration in Washington, labor is defying the nation by its interference with defense production to get its own demands. As a result, labor is rapidly losing public good will, and if these strikes continue will eventually lose support of the administration.

Electrical manufacturers have in several instances been the victims of labor's undefendable demands and it is understood discussions are under way in several other electrical establishments. A strike on one utility system was averted only at the last minute by the intervention of the governor of the state.

On the other hand, if government cracks down on labor, management must not take it as a signal that all is forgiven and that management can again lord it over labor. By a sort of rebound management has won considerable public approval at the expense of labor. This approval is one of the most valuable assets one can possess. It can be retained, however, only so long as it is merited.

## *Wholesale Power for REA*

IN THE last fiscal year REA purchased 406,000,000 kw.-hr., of which 53 per cent was from privately owned utilities and 47 per cent from publicly owned. The total sum paid to private utilities was around 1¾ millions. Administrator Slattery reports that all told REA co-ops have paid private utilities 4½ millions for wholesale energy.

The price paid to private industry last year was 1.23 cents and to public utilities 0.93 cent. The difference of 4 mills in a wholesale rate looks big until one analyzes it. Utility taxes last year averaged 17.6 per cent. Apply this figure and the difference shrinks to 8/10 mill. Surely this is small margin (6½ per cent of gross) to allow as margin for a company that turns its capital over but once in six years.

Some extra low rates, such as 4.4 mills for Colorado River Commission of Nevada and 5 mills for Bonneville and 5.9 mills for TVA, help to bring down the public rate average, so that one is forced to conclude that municipal plants, in spite of no taxes and no necessity for profit, charge REA as much as if not more than private companies for wholesale energy.

## *Output and Peaks*

EVER SINCE the first of the year the weekly output curve has been running counter-seasonal. At this time, which normally is but a month away from the yearly low, the curve is showing weekly figures but 4 per cent below the previous high. Should this trend continue a new all-time high will likely occur in June, for the first time probably in the history of the industry.

The peaks, however, are behaving in a more normal manner. Data on the sum of non-coincident peaks showed a reserve in December of slightly over 30 per cent. This, as is customary, was the low point. In January, however, the reserve was greater, and again in February. No March figures that could be used for comparison will be available for another three weeks, but it is expected that the reserve for the month rose past 40 per cent.

Thus the reserve is sufficient to provide not only against emergencies but also to allow sufficient time for overhaul. If to this reserve is added that available from interconnection, as well as the volume of new capacity due to start later in the year, it is difficult to see how any trouble will be encountered in meeting the 1941 peak.

## *Disintegration on the March*

AS WAS PREDICTED when the third term won last November, the "death sentence" clause is being invoked by SEC. Disintegration of public utility holding companies is on the march.

U.G.I., the first holding company to get a "blueprint" from SEC after indications that it would fight dismemberment, is now offering its interest in outlying properties to the public. Standard Gas is disposing of its San Diego property to bondholders and North American is divesting itself of control of Washington Railways.

Thus the act has met its first test on disintegration. The most important test will come when it denies companies with widely scattered properties the right to hold more than one small integrated system. Engineers Public Service and Commonwealth & Southern appear to be the first two companies in this classification which must make a decision. If they refuse to be limited to one small system and insist upon legal determination, the application of this section to large holding companies will have to await the decision of the Supreme Court. If, on the other hand, they accept the SEC blueprint, or an agreed upon modification thereof, the pattern will have been set.

How soon all this can be accomplished, provided there is no litigation, will depend very largely on how allergic the investing public is to public utility common stocks.

## A Central File for Priority Information

HOW CAN one get raw materials to fill orders for power companies? This is the question that a growing number of manufacturers is putting to us. In spite of the fact that electric power is the number one raw material of defense production there is no blanket priority for supplies for power companies. Our suggestion is the same as it was a month ago. The manufacturers and the utilities will help considerably, at least in reducing delay, by setting up jointly some means whereby utility defense load, in service and as added, can be listed and the information made available as needed to supplying manufacturers.

Unless some such plan as that is followed the individual manufacturers will have no other recourse than to ask their customers for this information. If several hundred manufacturers have to send questionnaires to their utility customers regularly it is going to be both expensive and annoying to both groups. How much simpler to have a central clearing house.

A central file by having the information up to date at all times will save everybody considerable time. An application for priority could then be made almost as soon as the order is signed.

It isn't only information on new construction that is needed but defense load on the lines as well. Utilities have to maintain stocks for repairs and replacements. A shortage of such stocks might be more serious with a going load than one under way.

And where supplies go through agents or wholesalers, the connection of such orders to specific defense loads is even less well defined. Nevertheless, it is essential that the equipment be supplied.

The central clearing house idea, we believe, has sufficient merit to warrant its consideration. Nor should any time be lost, for every day the raw material supply is becoming more difficult to maintain.

## No War Babies

THE 1940 financial reports for some 76 operating companies, representing approximately 40 per cent of the revenue of the entire electric utility industry, showed an aggregate increase in gross of 87 millions. The increase in net, on the other hand, was less than 8 millions. This in itself would not be so bad were it not for the fact that of the 76 companies more than half of them showed a lower net than in 1939.

Five companies reported a reduced gross for the year. Taking these out and leaving only properties with an increased gross, the figures show 37 below previous year's net against 34 with a gain.

This is the financial picture of a fast-growing industry beset by faster rising taxes. Because of different methods of reporting, it is not possible to determine what effect increased depreciation might have had.

The reports did show that improved position was due in some instances not to operations but to lower debt costs, either as the result of refinancing or of writing off security marketing costs in the previous year.

It is difficult to predict what will happen this year. Operating costs are going up. Fixed charges, on the other hand, while higher because of larger investment, are not advancing at the same rapid pace as output.

One thing, however, is certain, and that is that in spite of the tremendous demand for electricity utilities can never be called war babies.

## Reduction of Circuit Performance Records Doubtful Economy

PRESSURE to economize in such directions as to reduce system record keeping is coming at a time when a continuation of the records might prove to be of real dollar value. This is particularly true of records of performance of circuits and equipment. They contain the guide to bettered system reliability and continuity. Many companies are just beginning to use the compiled information to make decisions on the types of equipment and forms of protective arrangements to get adequate capacity with the lowest dollar outlays per interruption prevented by superior construction.

Everything hinges on the probability of failure of alternative ways of creating a particular source channel. What is the probability of failure of a cable or a pothead, of a conductor or a transformer, of a pole or an insulator? Are these risks independent of one another or does the occurrence of one enhance the likelihood of failure elsewhere?

This is a relatively new but extremely practical trend in economic analysis to fix on the cheapest way of doing a good job durably. Emphasis is still on getting the most kva. per dollar, but next in importance is getting the most hours of service per dollar spent to buy higher reliability.

As this attack gains ground it is sure to result in two things. Engineers are going to revive their interest in the mathematics of probability, and as they do they will cease to be amused by such data as that the probability of failure of a hundred feet of cable might be once in 812 years. They will see that this, coupled with similar data about other elements, might fix the kind of dual-feed switch-over installation to provide for an important war plant. But all this prognostication of probable failure is going to be trustworthy only if it is based on facts and not on hunches or guesswork. That's where system performance records come in and that's why they should not be ditched too readily to save a clerical dollar.

# Ickes Gets Setback

By CARTER FIELD

**This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him**

THAT Spokane 5 to 3 vote against throwing out the privately owned electric system merits a bit of study on the part of private utility officials before jumping to conclusions. Mail reaching senators and members of the House from that section indicates that it was nothing like as much of a repudiation for public power as it was for Washington bureaucracy in general and Harold L. Ickes in particular.

Letters from competent observers who have studied the Spokane situation, were there during the campaign, and have talked to many voters since, state that it was bitter local resentment against Washington, D. C., domination of Bonneville, and all that national officialdom represents, rather than any friendship for the idea of individual initiative and private control which decided the day.

This resentment, according to the judgment of these observers, is not confined to Spokane. They point to the recent decision of Tacoma, which, offered Bonneville power at very low rates, decided against taking it, though the decision involved an expenditure of local funds of $11,000,000 for an expansion of the city's hydro plant at Cushman. This followed the action of Eugene, Ore., which decided to build its own steam plant rather than take federally controlled power.

### *Three Camps*

To understand what is going on, and why this is not just of local importance, it is necessary to diagram the power battle now under way in Washington.

There are three camps. One is for expansion of publicly operated power projects on the TVA pattern. This means a separate commission, appointed by the President, for each geographical or river valley unit. This commission is responsible only to the President. The second group wants public power, but it wants each unit to be locally controlled, with no more federal domination, for example, than the RFC exercises over a private corporation to which it makes a large loan. The Ontario Hydro Commission is an example of this. The third group is that which wants complete federal domination, exercised through an administrator who would be a subordinate to the Secretary of the Interior. This is the plan for which Harold Ickes is fighting on the surface, and Ben Cohen under the surface.

Senator George W. Norris, father of TVA and one of the most determined and persistent foes of private ownership of the electric industry in the country, has definitely lined up against the federal bureaucracy notion of Mr. Ickes, as has David E. Lilienthal, Harry Slattery, rural electrification administrator, and the Federal Power Commission.

So far no national figure has espoused the cause of the strictly local control advocates, though it is predicted that there will be advocates before long, especially if the Northwestern congressmen should put a couple of ears to the ground.

For example, a bit of editorial from the Oregon *Daily Journal*: "People of the West just don't like the idea of being in the power of power-hungry Mr. Ickes, who is attempting to get control of all the public power projects of the West, including Grand Coulee, Bonneville, Central Valley and Boulder. Such a public monopoly in Mr. Ickes' hands, carrying with it the power of life and death over publicly and privately owned systems and over industry, would make the private power monopolies about which Mr. Ickes complains look like kid stuff.

"Westerners were pioneering in the power field before Mr. Ickes knew the difference between a.c. and d.c. . . . The West neither needs nor wants a tin-crowned Washington bureaucrat to give it lessons in power utilization or to crack the whip and yell 'Giddyap! Whoa!'

"Secretary Ickes is becoming an increasingly serious embarrassment to the President, who, in the broad public interest, would be fully justified in removing from the Interior Department all federal power administration."

### *Local Majority*

Then there is the Northwest Public Power Association, organized last January at Tacoma, and including Seattle, Tacoma, Eugene and nearly a score of other public plants. It has adopted resolutions as to how this public power in the Northwest should be administered. It wants control by a board of directors, a majority of which shall be named by the "public bodies now or hereafter operating their own electric power systems within the Northwest states and the balance to be appointed by the federal government."

Several of the "whereases" preceding this recommendation are of interest:

"Whereas the people of the Northwest, over a period of fifty years under local leadership and through local initiative, have established through political subdivisions of the state, public ownership and operation of power supply and distribution systems that now, under independent local management, have established the lowest rates and highest per capita consumption of electric energy in the U. S.

"Whereas the continued autonomy and success of local public power operation, and the development of an integrated regional power supply system upon sound economic lines is dependent upon and vitally affected by the management policy of any agency established for the marketing of Columbia River power.

"Whereas, under federal control and management, a change of national power policy through a change in national administration could impede or effectively destroy the accomplishments and continued progress of local public power in the Northwest, because of the dependence that must necessarily be placed upon the regional power supply system."

So if Mr. Ickes is to get what he wants it looks as though the President is going to have to soften up a lot of opposition for him.

# NEWS OF THE WEEK

## Wind-Driven Generator to Cap Grandpa's Knob

***Experimental 1,000-kw. unit to be mounted on structural steel tower 110 ft. high and driven by two-blade propeller with a wing spread of 175 ft. — Ties in with utility system***

What is believed to be the largest wind-driven generating unit ever built and the first to deliver alternating current for commercial use is now being installed at Grandpa's Knob, in the Green Mountains about 10 miles west of Rutland, Vt., with the expectation of going into operation in June. The installation is admittedly experimental, but it is being made on a scale which should test the feasibility of such units for utilizing winds in favorable localities.

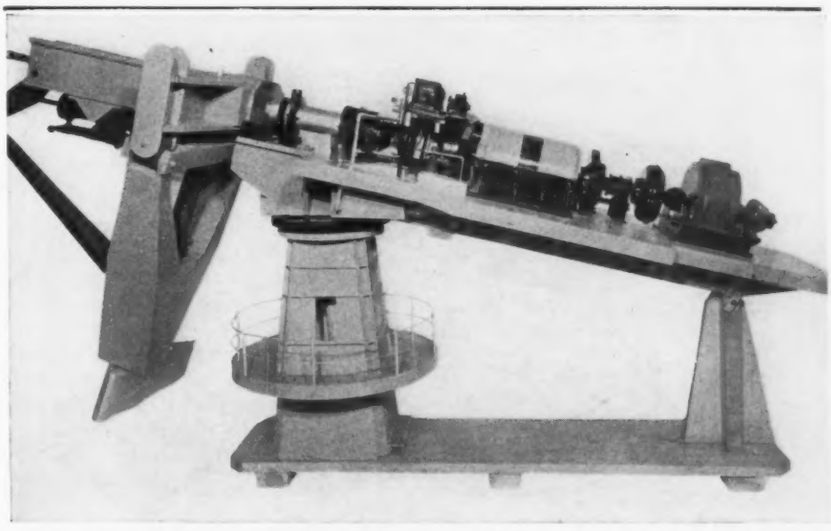
The generator rating is 1,000 kw. at 80 per cent power factor and the design provides for delivery of 2,300-volt, 60-cycle, three-phase energy to a transformer bank which will raise the potential to 44 kv. for transmission into the Central Vermont Public Service Corp. system over a 4-mile tie line. It is expected that the unit will be able to utilize winds for generation between 5,000 and 6,000 hours per year, at varying outputs and over a wind velocity range of from 18 to 150 m.p.h.

### *Tower 110 ft. High*

The structural steel tower suporting the generating equipment is about 110 ft. high, with concrete and steel grillage foundations 22 ft. deep. It was furnished by the American Bridge Co., and near by a 180-ft. anemometer tower has been erected for temporary measurements and records of wind velocities in the experimental period. The location of the plant is about 2,000 ft above sea level.

The generator is to be mounted about 110 ft. above ground and with a direct-connected exciter will be driven at 600 r.p.m. through hydraulic coupling and oil-immersed gearing driven in turn by a two-bladed propeller with a wing spread of 175 ft. The propeller blades are of shot-welded stainless steel built by the E. G. Budd Manufacturing Co. and weigh about 15,300 lb. each. They are each 65 ft. long x 11 ft. wide and the entire rotating mechanism of the unit as a whole weighs about 75 tons. The speed of the propeller blades is 30 r.p.m., and the design of the unit provides for fully automatic stabilization, the pitch of the blades being automatically controlled through an adjusting mechanism similar to that employed in Kaplan turbines. The blades are also free to cone down-wind against controllable restraint. The axis of the rotating equipment is inclined about 12 deg. below the horizontal, pointing downward against the wind, and no tail vane is provided. The blades are expected to "yaw" into the wind at all times.

The design provides for a fully automatic station, and if successful it is intended to develop units for operation in various sites under suitable supervision in groups. It is believed that such units would be of much value from the defense standpoint on account of their decentralization. The S. Morgan Smith Co. is financing the development and providing the mechanical equipment designs with the aid of various specialists and the Wellman Engineering Co.'s Cleveland shops. General Electric Co. designed and manufactured the electrical equipment and the engineering for the co-operating utility system centers in Nepsco Services, Inc., Augusta, Me.



**WIND OVER GRANDPA'S KNOB—Model of the 1,000-kw. wind-driven generating plant which is being erected in the Green Mountains about 10 miles west of Rutland, Vt., with part of one blade shown. The propeller has a wingspread of 175 ft.**

**NO. 1,000,000—Employees and officers of the Hotpoint Company, were jubilant as electric range 1,000,000 came off the production line last week. A national commemoration activity is to be promoted. Fred Krueger (holding Calrod unit) and Vice-President R. W. Turnbull (holding unit pan) compare features of the new range with those of 20 years ago. Mrs. Emma Brown (fastening ribbon) and Mr. Krueger have helped make Hotpoint ranges since 1919 and 1916, respectively. This range will join the first one made by Chairman George A. Hughes in 1910, which is now in the Greenfield Museum, Greenfield, Mich.**

## Attacks Bill Sponsored by REA as Unnecessary

Frank Harper, executive secretary of the Maryland Public Service Commission, told the House corporation committee that there is no need for the legislation the REA is sponsoring, and that it would only hurt the private utilities without helping the state's farm population. He said the utilities are doing a good job of extending power to farm sections.

REA seeks a law that will protect farm co-operatives which accept REA help in developing electric power, from "spite lines" run by utilities to keep the federal agency from commencing operations. REA may not operate in territories already served by private utilities.

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## Kentucky Co-Ops Favor $8,000,000 Power Plant

Members of the Jackson Purchase Rural Electric Co-operative Corp., at their fourth annual meeting in Louisville, Ky., adopted a resolution favoring construction of an $8,000,000 electric generating plant in the Western Kentucky coal mining area.

C. D. Harris, manager of the co-operative, said that the plant would probably be built near Sturgis and that eight REAs of West Kentucky, eight of southern Indiana and six of southern Illinois would obtain power from the plant. He added that the plant would be tied up with the TVA when the Kentucky Dam at Gilbertsville is completed in 1945.

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## Review Virginia Case

The Supreme Court decided this week to review a lower court decision in favor of Virginia Electric & Power Co. against the NLRB in which the NLRB ordered disestablishment of the Independent Employees Association of the utility.

## Commonwealth Edison to Spend $120,000,000

**Commonwealth Edison Co. plans a construction program of $120,000,000, of which $40,000,000 will be spent this year and the remainder in 1942 and 1943. Chairman C. Y. Freeman told stockholders this week that the company had advanced its schedules of construction so as to have adequate capacity to meet additional power load of defense work.**

**The company has ordered a 12,500-kw. topping unit for the Aurora, Ill., station to be ready in 1942.**

# NEWS BRIEFS

AN OFFER OF $100 is being made by Wisconsin Power & Light Co. to the first person furnishing proof that any city in Wisconsin or elsewhere has ever purchased or constructed a complete plant and facilities as proposed for Edgerton and completely paid for it out of earnings without raising taxes or charging higher rates than now prevailing. A proposal is before the city to take over the local electric system.

REPRESENTING 10,100 years of accumulated service, 355 Washington Water Power Co. veterans, each with at least 20 years service, were honored with service pins by President Kinsey M. Robinson. Old-timers with more than 50 years of service recounted experiences at the third annual Electric Trail Blazers' banquet.

SEC IS CONSIDERING adopting a rule requiring utility companies to ask competitive bids from underwriters when they want to sell securities. Sealed bids would be asked for issues over $1,000,000.

A BRIGHT IDEA has earned Rudolph Black, an employee in the radio transmitter department of General Electric at Schenectady, $800 so far. He first got $200 and this was increased by $600 as additional bonus because increased production of transmitters during the past year brought increased savings to the company.

ARKANSAS POWER & LIGHT CO. is using a series of dealer meetings to tell its story that there is no power shortage in its territory. Utility representatives are spurring dealers on in the appliance sales campaign, the largest in history.

FOR WINNING the state-wide accident prevention campaign, conducted by the Associated Industries of New York State, the Ontario district of Niagara, Lockport & Ontario Power Co. has been awarded a bronze plaque. The district had no lost-time accidents in more than a year.

THREE ENGINEERS OF Seattle City Light have been called to service in the armed forces. They are Murray Johnson, Joseph G. Polliack and Ford E. Van Voorhis.

A THREE-WEEKS summer management course from June 9-27 will be given by the State University of Iowa. Outstanding feature will be lecture and round-table sessions by well-known managers and industrial engineers. It is designed for those responsible for reducing manufacturing costs and increasing production during the emergency.

# Sees Utility Industry as Key in National Defense

***President Davis of Missouri Valley Electric Association tells engineering conference that present power supply is more capable of meeting demands than during last war period***

The United States in its present defense effort is more dependent on adequate power supply than perhaps at any other period of its history, and for that reason the utility industry is one of the most vital industries in national defense, Gen. George A. Davis, adjutant-general of the state of Oklahoma and executive vice-president of the Oklahoma Gas & Electric Co., declared in Kansas City last week.

Speaking before the thirteenth annual engineering conference of the Missouri Valley Electric Association, of which he is president, General Davis compared the industry's present position with its position in 1917-1918, when serious power shortages imperiled the country's defense effort.

### *Industry Responsibility*

"Today," he declared, "the industry is clearly conscious of its responsibility and is co-operating with the FPC to determine where additional power will be needed. While there are some apparent disagreements over power needs in certain critical areas in 1942, there are two important differences between the present power supply situation and that in 1917-18." They are:

1. In the present situation large additions to capacity are already under construction throughout the country, whereas in 1917-18 the industry postponed or curtailed construction because of rising costs.

2. Present advanced technical knowledge permits the power industry to take full advantage of interconnecting networks, a condition which was impossible in 1917-18.

Super-grid proponents, General Davis asserted, are seizing upon the present situation to push development of a major transmission grid in the United States, using large public power projects as "anchors," after the fashion of the British Grid. British engineers, on the other hand, after bitter experience in the present war are advocating a grid system with a multiplicity of small, widely scattered plants, he said.

The two-day engineering conference, at which 65 papers were presented in fifteen separate sessions, attracted an attendance of nearly 400 utility and electrical manufacturers' representatives from the five states of Iowa, Missouri, Kansas, Nebraska and Oklahoma.

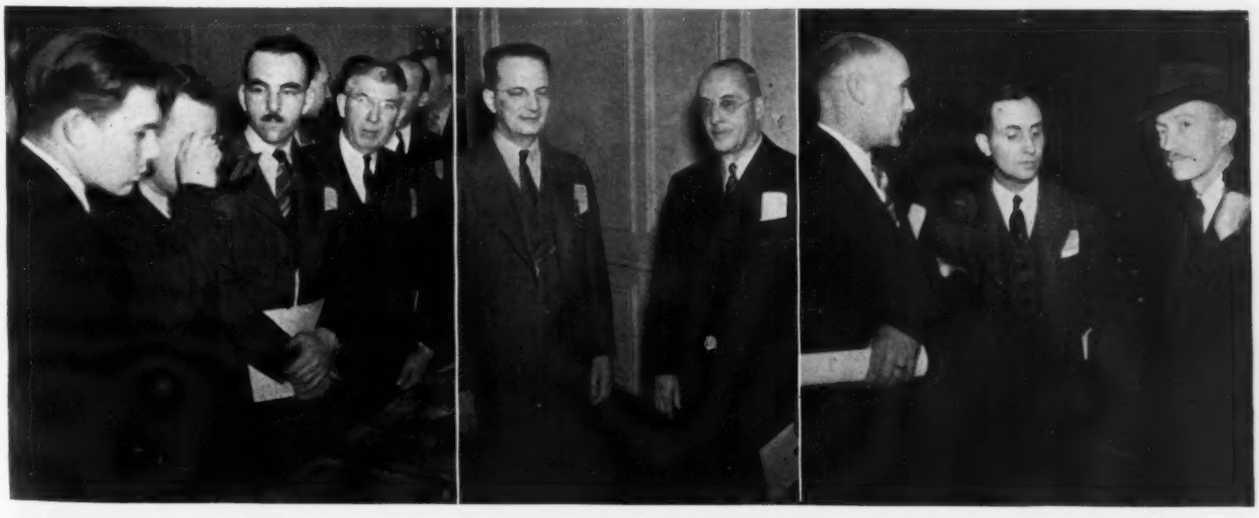
### *Cooling Towers*

O. H. Brand (Iowa-Nebraska Light & Power), in comparing cooling tower and spray pond operation on his property, found the spray pond more efficient for less cost than a cooling tower if real estate was no consideration.

Ralph Coursey (Oklahoma Gas & Electric) found the $800-$1,000 cost of load surveys on underground network systems more than justified, particularly now when loads are growing rapidly and this relatively small investment might save cost of one or two vaults at several thousand dollars each. Of like mind was T. G. Hieronymus, Kansas City, who reported that sudden unannounced mushrooming of loads in small out-of-the-way shops was bringing dangerous transformer overloading.

Fred Gilpin (Kansas City Power & Light) reported on residential demand and diversity studies in Kansas City. Findings indicated that: Addition of a refrigeration load to pure lighting increased individual demand 20 per cent, consumption 80 per cent; addition of range load increased individual demand

**C. D. Lyman, Kansas City Power & Light, and H. M. Turrell, Kansas Power Transmission Co., Inc., beside protected series capacitor unit developed for use on low capacity lines of the Kansas City Company**



**CONFERENCE—Seen during the engineering conference of the Missouri Valley Electric Association in Kansas City last week. At left shows delegates grouped around display of aerial photographs used in utility survey work. Center is C. W. Minard, Nebraska Power and general chairman of the engineering group, and George A. Davis, Oklahoma Gas & Electric and M.V.E.A. president. Right: C. F. Moulton, Nebraska Power; C. C. Willis, Oklahoma Gas & Electric, and J. A. Keeth, Kansas City Power & Light**

225 per cent, consumption 85 per cent, while superimposing a water heater on refrigeration, range and lighting load increased individual demand 40 per cent and consumption 95 per cent. He found indications of a definite ration of 100:1 between annual kilowatt-hour and maximum demand for individual customers and pointed to the possibility of a scheme being worked out for estimating customer demand from annual energy consumption records.

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## Opponents Air Views on St. Lawrence Pact

The New York Assembly last week by a vote of 80 to 63 passed a bill designed to hinder the St. Lawrence seaway project by prohibiting the State Power Authority from acting in navigation matters.

Assemblyman Jerome C. Kreinheder, Republican, of Buffalo, author of the bill, said that President Roosevelt was acting arbitrarily and contrary to the interests of New York State when he entered into the agreement with Canada.

"There is no justification," he said, "for linking a visionary, impractical, harmful seaway project with power development." Mr. Kreinheder said that "the seaway would never be self-supporting" and that public sentiment "in this state overwhelmingly is opposed to the St. Lawrence seaway."

In Washington Senator Bennett C. Clark, Democrat, of Missouri, announced that he would ask the Senate foreign relations committee to rule that the St. Lawrence agreement is a treaty, requiring a two-thirds Senate vote for ratification.

At Montpelier Senator Ernest A. Spear of Woodstock introduced a resolution in the Vermont Senate terming the seaway project an "act of national folly."

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## Mississippi Co-Ops May Build Generating Plants

A proposal calling for the construction of several generating plants to serve several Mississippi REA co-operatives has been announced by State Senator E. A. Ford of Taylorsville, chairman of the state rural electrification authority.

The plan calls for most of the REA projects to be ready to launch their own generating operations within the next six months. Senator Ford revealed the proposal following his return from Washington, where he conferred with REA officials. The new generating units will be constructed only in the areas outside of the TVA.

## SEC Blocks Banker Fee in Sale of Utility Bonds

Last week SEC ruled that there was an absence of arm's-length bargaining between Morgan Stanley & Co., Inc., in connection with the sale in February, 1940, of $25,000,000 of first mortgage bonds of Dayton Power & Light Co. and refused to permit payment of underwriters' fees. SEC ordered that the fees totaling $100,562 be returned to the utility.

Morgan Stanley & Co. stated that "it is impossible to understand how the commission has arrived at this opinion in view of the facts presented during the hearings."

SEC admitted that its finding rests "upon reasonable inferences and conclusions drawn from the basic facts." It held that the rule is applicable if underwriter stands in such relation to issuer that "there is liable to be or to have been an absence of arm's-length bargaining with respect to the underwriting transactions between them."

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## REA Co-Ops to Buy Brazos River Power

Under threats of Congressman Robert Poage of Waco that the district would be "disowned" by the federal government, directors of the Brazos River Reclamation and Conservation District voted last week to approve a contract under which the electric power to be generated at Possum Kingdom Dam will be sold to a federally financed agency, the Brazos River Transmission Electric Co-Operative, Inc.

Congressman Poage warned that the district would be shut off from future aid in the construction of other dams contemplated for flood-control purposes unless the contract was approved, although the district will receive less revenue from the new agency than had been offered by private utilities.

The directors rejected an offer of Texas Electric Service Co. to purchase for $306,000 a year the power output of the dam, against $203,935 offered by the transmission co-operative. TESCO would sell part of the output to 30 rural electrification networks and part would go to municipal distribution systems at Weatherford and Seymour at rates lower than those systems could obtain it from any other agency.

The proposed transmission lines would duplicate the existing one of Texas Power & Light Co. The co-operative estimates the cost of the new lines in excess of $2,000,000, which would be advanced by REA, and transmit power to fifteen REA systems.

The Possum Kingdom Dam will not be completed for about a year. Cost of the dam and power house is approximately $7,500,000, of which $4,000,000 was a WPA gift and $3,500,000 obtained from public sale of securities. Approximately fifteen REA co-ops are now buying power from Texas Power & Light and Texas Electric Service at a rate of 6.67 mills. The transmission co-operative proposes a rate of 7.64 mills. Installed capacity of the dam is to be 22,500 kw.

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## Public Power Fight Hurts Defense Plan

Continued bickering and controversy over public versus private operation of power facilities will seriously affect national defense preparations, was the consensus among several speakers appearing before the annual business development section conference of the Northwest Electric Light and Power Association last week in Spokane.

Condemnation proceedings, special elections and other costly and wasteful affairs forced on the private utilities in the Pacific Northwest are diverting human energy and wealth that might otherwise be devoted to productive defense efforts, was the opinion of Sam P. MacFadden, vice-president of Puget Sound Power & Light Co.

Contrasted with this is the way all utilities, public and private, in Canada are tieing into defense activities under the war conditions existng in that country, as described by E. W. Bowness, vice-president Canadian Utilities, Ltd. There the utilities have swept aside rivalries and differences and have gone about providing additional facilities even though the expected business might not justify all the capital investment required.

George H. Wisting, Northwestern Electric Co., stated that the power industry is one industry in which there will be no bottleneck.

Kinsey M. Robinson, president Washington Water Power Co., said that now is the time for co-operation between the federal power plants in the region and the private utilities in the job of providing America with preparedness material.

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## Drop Show-Cause Order

Federal Power Commission has entered an order approving certain proposed journal entries submitted by Peoples Light Co. of Davenport, Iowa, and has dismissed a show-cause order relating to such accounting adjustment.

# Pacific Power & Light to Add to Distribution

***President McKee says company will spend $629,500 during year to supply capacity for load growth — Pacific Northwest utility studies service facilities to provide power for all demands***

Major construction projects of Pacific Power & Light Co. this year will be for distribution facilities. The company has set a construction budget of $629,500, as against $1,027,057 spent last year. The program will be financed from company funds.

President Paul B. McKee stated that no addition or extension of existing transmission lines is contemplated, but provision has been made for a physical connection with the Bonneville transmission system at Astoria, Ore., where 1,500 kw. of supplementary power will be purchased by the company from the government.

### *To Buy Transformers*

It is planned to purchase three 1,500-kva. transformers for the Walla Walla, Wash., substation, Mr. McKee said, because of load growth. Transformer replacements will be required at several other locations, using transformers now on hand.

The total construction budgets compare as follows:

| | 1941 | 1940 |
|---|---|---|
| Production plant | $27,000 | $101,919 |
| Transmission plant | 19,300 | 27,624 |
| Distribution plant | 539,800 | 821,649 |
| Steam heat department | 600 | 600 |
| Water department | 10,800 | 19,694 |
| Buildings and equipment | 32,000 | 55,571 |
| Total | $629,500 | $1,027,057 |

During 1940 the company installed a 3,000-kw. General Electric steam turbine with auxiliaries and control equipment at Bend, Ore., under a contract arrangement with a sawmill there, to meet growing load demands on the company's central Oregon system. This turbine went into service January 1, 1941.

Mr. McKee said that three 2,000-kva. transformers were installed at Pendleton to supply capacity for load growth. Transformer capacity in several other locations was increased because of growing load, but required no new units.

The greater part of the year's expenditures was for distribution facilities, this item accounting for $821,649. Of this amount $582,000 was for extending facilities to customers not previously served, including rural extensions.

Last year the company built 155 miles of rural lines and estimates that 50 miles will be built this year. The net increase in farm customers during the year was 744, and it is estimated that 300 more will be added during 1941. The 1940 figure was influenced by the acquisition during the year of the small distribution systems of the Knappa-Svensen Electric Co. and the Hermiston Light & Power Co. The average annual use per farm customer in 1940 was 2,155 kw.-hr.

Company customers purchased $4,876,521 of electrical merchandise during 1940, of which 91 per cent was handled by dealers with whom the company co-operates in its load-building activities. It is estimated that 1941 volume will be $4,939,000. E.A.R. for 1940 is estimated at $682,962 and for 1941 at $597,222. Average annual residential use was 1,606 kw.-hr. in 1939, 1,689 in 1940 and is estimated to reach 1,736 in 1941.

Mr. McKee stated that the company carries on a continuous study of service facilities and of loads and capacities available at each load center. These studies, he said, were supplemented in 1940 by a comprehensive check of the Pacific Northwest network on the Westinghouse calculating board.

With respect to guarding against possible sabotage of utility facilities, Mr. McKee said that the company has intensified normal protective measures and is working co-operatively with the proper authorities.

Existing generating facilities of Pacific Power & Light Co. system and on the system with which it is connected are expected to be fully adequate to care for any defense industries likely to develop in the territory. The companies in the area have all been looking to Bonneville and Grand Coulee as a source of additional power to meet future load growth. A co-operative attitude on the part of the government toward the utilities of the area, it is said, is all that is needed to guarantee an adequate supply of power.

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## May Resume Power Plan

Due to the increasing demand for electric power for war industries, the British Columbia Electric Railway Co. may proceed with its power development scheme in the Bridge River. The development plan was started more than ten years ago at Bridge River, at which time the company spent some $3,000,000 on a 13,200-ft. tunnel, and then temporarily suspended work on the project when the depression cut down power requirements. Complete development of the waterway is estimated at $18,000,000.

**NEW STREET LIGHTING—Improvements made in Lorain, Ohio, are designed to meet modern requirements of night motorists and pedestrians. This view, taken along South Broadway, shows the high level of lighting produced by luminaires developed by General Electric engineers and installed by Ohio Public Service Co. Of the pendent type, the 10,000-lumen luminaires are mounted 25 ft. and spaced 100 ft. apart**

## A.L.E.A. Holds Preview of Residential Fixtures

A sales estimate for 1941 of 400,000 units was announced by the recently formed American Lighting Equipment Association at a New York preview last week of its first certified residential lighting fixtures.

Fixtures certified under this plan carry tags stating that they have been tested by the Electrical Testing Laboratories to conform to the "Recommended Practice for Illumination Performance of Residential Ceiling Luminaires" of the Illuminating Engineering Society as well as by the A.L.E.A. advisory board of design for esthetic appeal. Sales program of the association is aimed at modernizing the outmoded direct lighting fixtures now in use in more than three-quarters of American homes.

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## Six Prizes Are Awarded in Data Sheet Contest

Prizes in the Northwest Electric Light & Power Association data sheet contests have been awarded to authors of the six best commercial and industrial utilization data sheets issued in 1940. Winners were, in the commercial cooking data sheet contest: First, J. E. Dugan, Puget Sound Power & Light Co.; second, Alex E. Lacroix, Washington Water Power Co.; third, O. C. Rawlings, California Oregon Power Co.

In the contest for data sheets covering miscellaneous commercial and industrial heating applications the following were winners: First, W. L. King and Carl L. Hoffman, Washington Water Power Co.; second, H. Van Wyk, Puget Sound Power & Light Co.; third, T. N. Hunt and Albert Gruber, Washington Water Power Co.

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## Withdraw Plan to Effect Sale of Facilities

Federal Power Commission has been notified jointly by the companies involved that the offer of sale of the facilities of Northern Pennsylvania Power Co. to Metropolitan Edison Co., both Pennsylvania subsidiaries of Associated Gas & Electric Corp., has been withdrawn and will not be consummated.

The proposed sale, having approval of the commission, was initiated during 1935 and terms and conditions were ratified by the respective boards of directors in 1938.

Resolutions recently adopted by directors of the two companies, copies of which have been filed with the commission, state that it has been mutually agreed that it would be inexpedient and impractical to proceed further with the acquisition and sale on the basis proposed. The notice withdraws the joint petition filed January 4, 1941, requesting a further extension of time within which to consummate the sale.

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## Plan $70,000 Addition

Wisconsin Public Service Commission has granted the River Ralls municipal electric utility permission to install additional generating facilities at a cost of approximately $70,000. The project will include a new building, installation of a Diesel generating unit and transformers and wiring changes.

## Employees Told It Takes $35,000 to Create a Job

Taxes of Consolidated Edison Co. of New York, Inc., and its system companies totaled $1,626 for the average employee during 1940, according to the annual report to employees. The system's tax bill more than doubled in ten years, rising from $29,000,000 in 1930 to $58,500,000 in 1940.

During 1940 the average pay of weekly employees was $37.85, including overtime. The report to the employees pointed out that it takes more than $35,000 to create each job in the system. The system paid $80,311,000 for wages, salaries and pensions during 1940. It was stated that 45.2 per cent of employees are 40 years of age or over and that every eighth employee is a woman.

# COMING MEETINGS

**National Accounting Conference**—American Gas Association-Edison Electric Institute, Netherland Plaza Hotel, Cincinnati, Ohio, April 7-8.

**Midwest Power Conference**—Fourth annual meeting, Palmer House, Chicago, Ill., April 9-10. Charles N. Nash, conference secretary, Illinois Institute of Technology, 3300 Federal St., Chicago, Ill.

**Missouri Valley Electric Association**—Rural and sales conference, April 14-15; spring accounting conference, Continental Hotel, Kansas City, Mo., May 22-23. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln, Neb.

**Northwest Electric Light and Power Association**—Engineering and operation section, Portland, Ore., April 16-18. Paul P. Ashworth, chairman, Telluride Power Co., Richfield, Utah.

**Electrochemical Society**—Spring meeting, Cleveland, Ohio, April 16-19. Colin G. Fink, secretary, Columbia University, New York, N. Y.

**Maryland Utilities Association**—Spring meeting, Lord Baltimore Hotel, Baltimore, Md., April 18. G. F. Jones, secretary, Potomac-Electric Power Co. Building, Washington, D. C.

**Porcelain Enamel Institute**—Annual meeting, French Lick Springs Hotel, French Lick, Ind., April 17-18.

**Greater New York Safety Council**—Annual safety convention and exhibit, New York, N. Y., April 22-25. Greater New York Safety Council, Inc., Lincoln Building, 60 East 42d St., New York.

**Missouri Association of Public Utilities**—Annual convention, Elms Hotel, Excelsior Springs, Mo., April 23-25. Jesse Blythe, assistant secretary, Merchants Bank Bldg., 101 West High St., Jefferson City, Mo.

**Illuminating Engineering Society**—Pacific Division, second annual lighting conference, Pacific Gas & Electric Co., auditorium, 245 Market St., San Francisco, April 25-26. William P. Bear, general chairman, 245 Market St., San Francisco.

**Arkansas Utilities Association**—Annual convention, Arlington Hotel, Hot Springs National Park, Ark., April 28-29. R. E. Ritchie, secretary, Post Office, Box 551, Little Rock, Ark.

**Association of Iron and Steel Engineers**—Spring conference, Youngstown, Ohio, April 28. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

**American Institute of Electrical Engineers**—North Eastern District, Rochester, N. Y., April 30-May 2; summer meeting, Toronto, Canada, June 16-20. H. H. Henline, national secretary, 29 West 39th St., New York, N. Y.

**Southeastern Electric Exchange**—Annual conference, Bon Air Hotel, Augusta, Ga., May 1-3. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta, Ga.

**National Metal Trades Association**—Annual convention, Palmer House, Chicago, Ill., May 8-9. Harry S. Flynn, secretary, 122 S. Michigan Av., Chicago, Ill.

**National Electrical Manufacturers Association**—Spring meeting, The Homestead, Hot Springs, Va., May 11-15. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

**National Fire Protection Association**—Annual meeting, Royal York Hotel, Toronto, Canada, May 12-17. Robert S. Moulton, technical secretary, 60 Batterymarch St., Boston, Mass.

**National Electrical Wholesalers Association**—Annual convention, The Homestead, Hot Springs, Va., May 18-22. E. Donald Tolles, managing director, 165 Broadway, New York, N. Y.

**Pacific Coast Electrical Association**—Annual convention, Hotel del Coronado, Coronado, Calif., May 21-24.

**Empire State Gas & Electric Association**—Electric operating group, Van Curler Hotel, Schenectady, N. Y., May 23. George H. Smith, secretary, Grand Central Terminal, New York, N. Y.

**Public Utilities Advertising Association**—Annual convention, Hotel Statler, Boston, Mass., May 26-27. James Macdonald, chairman, Boston Edison Co., Boston.

**National Association of Purchasing Agents**—Annual convention, Chicago, Ill., May 26-29. G. A. Renard, executive secretary-treasurer, 11 Park Place, New York, N. Y.

**Edison Electric Institute**—Annual convention, Buffalo, N. Y., June 2-5. Major H. S. Bennion, managing director, 420 Lexington Av., New York, N. Y.

**American Society of Heating and Ventilating Engineers**—Semi-annual meeting, Palace Hotel, San Francisco, Calif., June 16-19. A. V. Hutchinson, secretary, 51 Madison Av., New York, N. Y.

**Pacific Heating & Air Conditioning Exposition**—Exposition Auditorium, San Francisco, Calif., June 16-20. Publicity Department, Pacific Heating & Air Conditioning Exposition, Grand Central Palace, New York, N. Y.

**American Society of Mechanical Engineers**—Semi-annual meeting, Kansas City, Mo., June 16-20. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

**American Society for Testing Materials**—Annual meeting, Palmer House, Chicago, Ill., June 23-27. R. E. Hess, assistant secretary, 260 South Broad St., Philadelphia, Pa.

**Canadian Electrical Association**—Annual meeting, Seigniory Club, P. Q., Canada, June 25-27. B. C. Fairchild, secretary, 804 Tramways Bldg., Montreal.

## Power Output Drops Slightly in Week

The dip in power production for the week ended March 29 from the preceding week was about 0.25 per cent and was slightly under the rate recorded the week before. The pattern remains about unchanged, with only seasonal factors determining the course. The high rate of industrial use is more than offsetting the normal seasonal decline due to more hours of daylight.

Total production for the week was 2,802,255,000 kw.-hr., a gain of 15.7 per cent over a year ago, according to report of the Edison Electric Institute. As compared with the like week of 1939 the gain was 26.8 per cent. The trend of the output curve resembles somewhat the 1937 pattern, with the exception of the 1937 dip at this time.

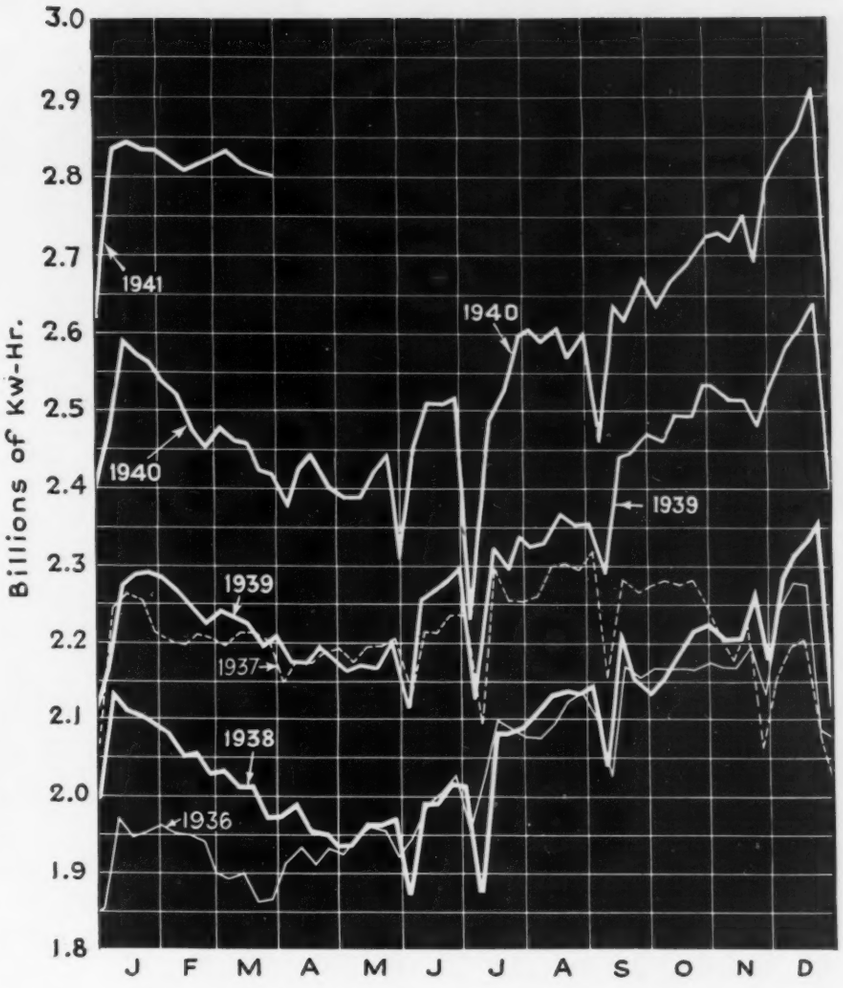
Per cent changes in the different geographic regions are being affected by strikes which have closed plants or partially slowed down defense and industrial production. However, the high rate of power output has been maintained on the level of previous weeks this year.

**Weekly Output, Millions Kw.-Hr.**

| 1941 | | 1940 | | 1939 | |
|---|---|---|---|---|---|
| Mar. 29 | 2,802 | Mar. 30 | 2,422 | April 1 | 2,210 |
| Mar. 22 | 2,809 | Mar. 23 | 2,424 | Mar. 25 | 2,198 |
| Mar. 15 | 2,817 | Mar. 16 | 2,460 | Mar. 18 | 2,225 |
| Mar. 8 | 2,835 | Mar. 9 | 2,464 | Mar. 11 | 2,238 |
| Mar. 1 | 2,825 | Mar. 2 | 2,479 | Mar. 4 | 2,244 |
| Feb. 22 | 2,820 | Feb. 24 | 2,455 | Feb. 25 | 2,226 |
| Feb. 15 | 2,810 | Feb. 17 | 2,476 | Feb. 18 | 2,249 |
| Feb. 8 | 2,824 | Feb. 10 | 2,523 | Feb. 11 | 2,268 |
| Feb. 1 | 2,830 | Feb. 3 | 2,541 | Feb. 4 | 2,287 |
| Jan. 25 | 2,830 | Jan. 27 | 2,566 | Jan. 28 | 2,293 |

**Per Cent Change from Previous Week**

| | Week Ending | | |
|---|---|---|---|
| | Mar. 29 | Mar. 22 | Mar. 15 |
| New England | +19.4 | +20.3 | +16.5 |
| Middle Atlantic | +13.2 | +13.8 | +12.1 |
| Central Industrial | +19.5 | +20.2 | +18.5 |
| West Central | +12.4 | +10.9 | + 8.8 |
| Southern States | +20.8 | +20.0 | +17.4 |
| Rocky Mountain | +12.1 | +13.8 | +10.5 |
| Pacific Coast | + 5.0 | + 6.0 | + 8.7 |
| Total United States | +15.7 | +15.9 | +14.5 |




## Georgia Bill Would Tax Utilities on Gross Sales

Power companies in Georgia will be compelled to pay a 2 per cent sales tax on gross earnings as well as on appliances sold if a measure introduced in the General Assembly is passed.

The measure provides that power companies, as well as merchants, shall make a monthly return of gross receipts to the state revenue commissioner for the purpose of computing the tax each month. The present administration has gone on record as being opposed to a sales tax.

•

## Grand Valley Dam Project

Construction of the $22,000,000 Grand Valley dam project on the south fork of the Snake River in Idaho has been approved by the army engineer board, according to Representative Dworshak (Rep., Idaho). The project contemplates a dam, reservoir, power plant, transmission lines and channel rectification on the south fork of the Snake east of Idaho Falls.

•

## Detroit Edison to Start Work on Marysville Plant

Detroit Edison Co. has decided to start work on the substructure for an addition to the Marysville power plant to accommodate one 75,000-kw. turbo-generator and two boilers. This will only increase total expenditures for the year to about $14,250,00, since most of the Marysville expenditures will be incurred in 1942.

Previously the company had announced a budget of about $14,000,000 with the installation of a 75,000-kw. turbo-generator set at Delray power house No. 3. The company also plans line extensions and meters to 28,000 new customers.

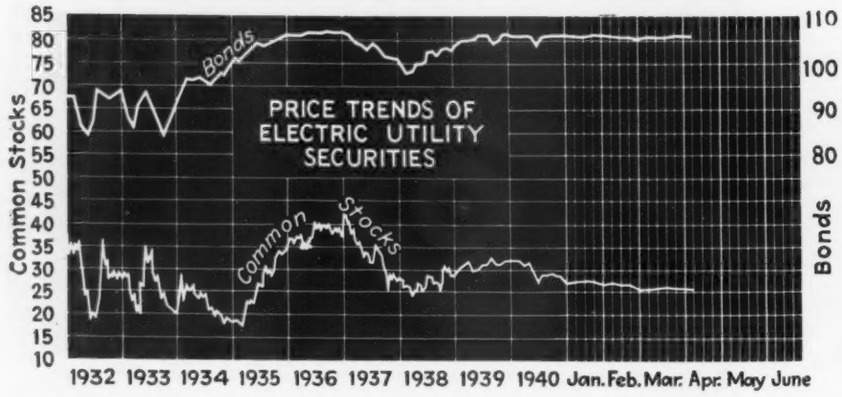
## Boonville Plant Trial Postponed Until April

Trial of the case involving the appraisers' report on the valuation of the Southern Indiana Gas & Electric Co.'s electric light plant in Boonville in the suit of the city of Boonville to take over the plant for municipal operation has been postponed in the Warrick Circuit Court by Special Judge A. Dale Eby of Princeton.

The trial was postponed only after both parties had agreed with the court that they would waive trial by jury and waive all rights to a change of venue from Warrick County. The trial was reset for April 21.

Several years ago there was a special election in Boonville and the proposition for the city to take over the property of the Southern Indiana Gas & Electric Co. was carried by a small majority. There has been considerable litigation over the question since that time.

## Utility Stocks Dip; Bonds Turn Upward


PRICE TRENDS OF
ELECTRIC UTILITY
SECURITIES
Bonds
Common Stocks
Common Stocks
Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1932 1933 1934 1935 1936 1937 1938 1939 1940 Jan. Feb. Mar. Apr. May June

**Only slight changes occurred in the prices of electric light and power stocks during the past week. "Electrical World" index, 25.8; last week, 25.9; last year, 31.6. The bond index stood at 106.0; last week, 105.9; last year, 106.3**

## Ohio Power Issue Placed on Market

First mortgage 3 per cent bonds, due in 1971, of the Ohio Power Co. and 202,403 shares of 4½ per cent cumulative preferred stock were offered to the public recently. The offering of the preferred was subject, however, in the case of 169,403 shares, to the prior exchange privilege extended to holders of the company's outstanding 6 per cent preferred stock, other than American Gas & Electric Co., whose shares are to be bought for cancellation.

The bonds were priced at 102¼ and the preferred stock, which is of $100 par value, was offered at $108 a share, plus accrued dividends from March 1.

Under an exchange offer, holders of the 6 per cent preferred stock of the company, other than American Gas & Electric Co., have the privilege of exchanging their stock, share for share, for the new preferred plus an amount in cash equal to the difference between the redemption price of the old stock and the public offering price of the new.

•

## Sells Preferred Equity in Washington Utility

Sale of its entire holdings of voting preferred stock in Washington Railway & Electric Co. has been announced by the North American Co. According to a statement a short time ago by Edward L. Shea, president, the holding company intends to pursue a policy of reducing the interest in the Washington utility to conform with the probable limits of the Holding Company Act.

Funds obtained from the sale of the preferred stock, totaling approximately $1,500,000, will be placed in the general working funds of the top company. The 12,827 shares of the 5 per cent preferred issue held by North American represented about 15 per cent of the total and were sold to a group of fifteen insurance companies and other institutional investors.

•

## Dividends Declared

Directors of the Cities Service Power & Light Co. have declared dividends of $7.50 on the $5 preferred, $9 on the $6 preferred and $10.50 a share on the $7 preferred stocks. The issues have been in arrears.

Montana-Dakota Utilities Co. has declared a dividend of 10 cents per share on the common stock of the company, paid on April 1, 1941, to stockholders of record March 15. In the previous quarter a dividend of 6 cents per share was paid.

•

## Court Appoints Receiver

Justice Middleton in Toronto, Canada, has appointed the National Trust Co. receiver and manager of the Mexican Light & Power Co., Ltd. The appointment was made in an action brought by trustees for holders of first mortgage bonds.

•

## Registers Common Stock

Connecticut Light & Power Co. has filed a registration statement with the Securities and Exchange Commission covering 701,253 shares of common stock, without par value. The shares are outstanding and are presently held by the United Gas Improvement Co. After the sale of the stock the U.G.I. will own no securities of Connecticut Light & Power Co. Proceeds from the sale of the stock are to be received by the parent company and not by the Connecticut Light & Power Co.

•

## Utility to Proceed With Refinancing

Virginia Corporation Commission has authorized East Tennessee Light & Power Co. to proceed with its plan for refinancing its entire funded debt of $5,909,500.

Under this plan East Tennessee Light & Power will sell $4,800,000 of 3½ per cent first mortgage bonds, due 1966, at 102½ privately, and 22,140 shares of common stock to its parent, Cities Service Power & Light Co.

The commission directed that expenses incurred in the refunding operation should not exceed $130,000 without its approval and that the company pay no commission in excess of 0.75 per cent on the aggregate principal amount. The company was also ordered not to pay dividends on its common stock except out of earnings accruing subsequent to October 31, 1940, unless previously approved by the commission.

•

## Hydro Gets $15,000,000 Loan at 2½ Per Cent

Negotiations have been completed between the Ontario Hydro-Electric Power Commission and a syndicate handling the Hydro's $15,000,000 loan under which the interest rate and the date of maturity both will be reduced.

The issue remains at $15,000,000 but with the interest rate at 2½ per cent instead of 3 per cent and term of maturity eight years instead of thirteen. Government officials said the reduced interest rate, insisted on by Premier Hepburn, would mean a saving of more than $500,000 to Hydro users.

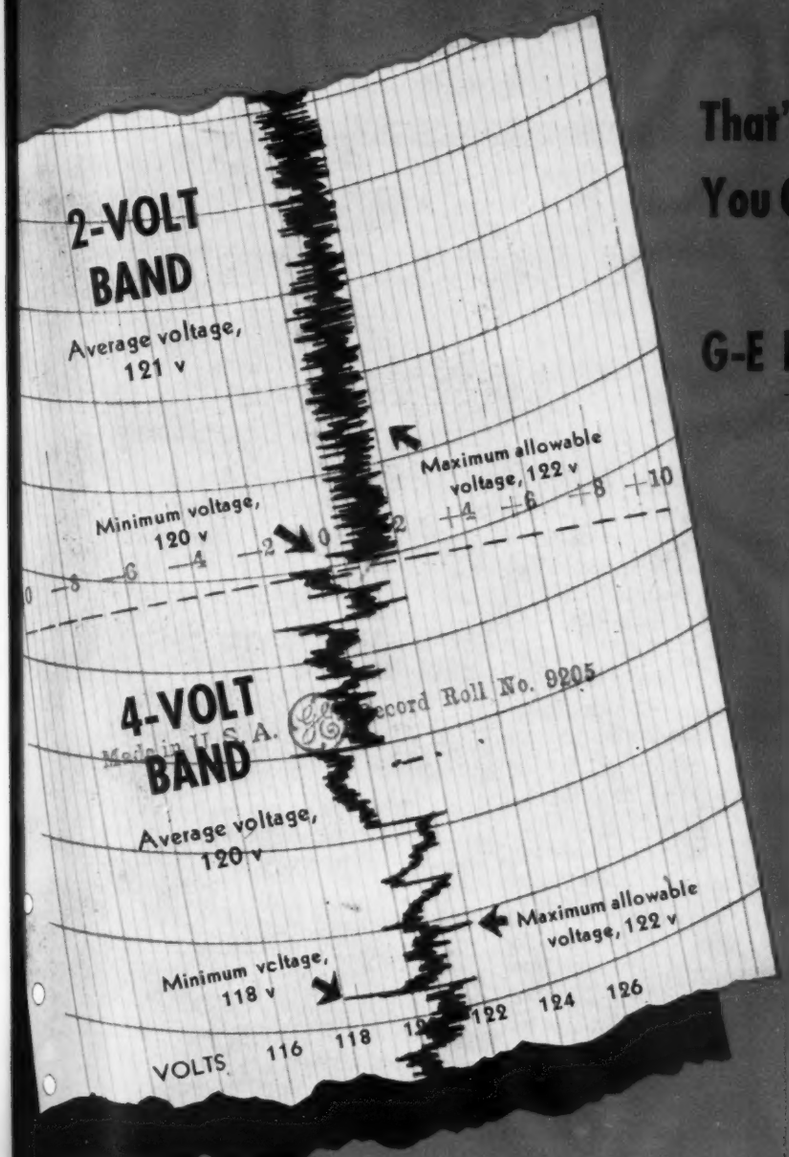
## Utility Reports

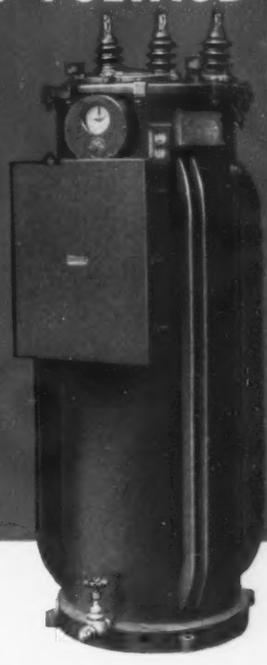
| | Net Income | |
|---|---|---|
| | 1941 | 1940* |
| *Alabama Power | $3,190,258 | $4,083,779 |
| *Arkansas Power & Light | 1,197,943 | 1,236,513 |
| †Commonwealth & Southern and subs. | 13,597,798 | 13,658,606 |
| *Consumers Power | 11,052,863 | 9,792,051 |
| *Dallas Power & Light | 2,036,816 | 1,605,058 |
| †Detroit Edison and subs. | 11,071,117 | 9,801,339 |
| *Houston Lighting & Power | 2,939,385 | 2,766,989 |
| *Idaho Power | 1,504,550 | 1,523,958 |
| *New Orleans Pub. Serv. | 2,652,124 | 2,049,138 |
| *Ohio Edison | 4,144,924 | 4,158,857 |
| †Public Serv. Corp. of N. J. and subs. | 23,416,511 | 25,736,439 |
| *Texas Electric Service | 1,254,515 | 1,406,996 |
| *Utah Power & Light and subs. | 2,039,330 | 1,397,772 |

*Twelve months ended January 31.
†Twelve months ended February 28.

# 2 VOLTS = 1 VOLT

## BAND WIDTH — HIGHER AVERAGE VOLTAGE


2-VOLT BAND
Average voltage, 121 v
Maximum allowable voltage, 122 v
Minimum voltage, 120 v
4-VOLT BAND
Average voltage, 120 v
Maximum allowable voltage, 122 v
Minimum voltage, 118 v
VOLTS 116 118 122 124 126



## That's the Reason Why You Get EXTRA Dividends from G-E Induction Regulators

THE chart at the left is a true-to-life picture of two kinds of feeder-voltage regulation. The top portion shows the 2-volt effective band width held by G-E induction regulators. The bottom part shows the 4-volt effective band held today on many feeders by regulators of other types.

The narrower band—2 volts instead of 4 volts or more—means that a *1-volt higher average voltage* can be held on a feeder without exceeding the allowable maximum.

The benefit of the 1-volt gain will vary for different feeders and may be evaluated in various ways by different power companies. But it can be used to advantage on every feeder.

It can be used to recover lost revenue—$1,000 annually on a typical feeder. It can be used to increase load-carrying capacity—by as much as 67 per cent. Or, it can be used to extend feeder length—by as much as 30 per cent.

Find out what the narrower band width held by G-E induction regulators can mean on your feeders. Ask your G-E representative how much you can gain in feeder length, load capacity, or recovery of revenue. He will show you on simplified charts. General Electric Co., Schenectady, N. Y.

### It Pays to Look at Band Width When You Buy Regulators

| | 4-VOLT BAND | 2-VOLT BAND |
|---|---|---|
| Maximum allowable voltage | 122 | 122 |
| Voltmeter band setting | ±1 volt | ±1 volt |
| Time delay | Yes | No |
| Minimum voltage | 118 | 120 |
| AVERAGE VOLTAGE LEVEL | 120 | 121 |

# GENERAL ELECTRIC

404-26-5400

# OPERATING PRACTICES

## Current Capacity of Copper Braid*

By JULIAN ROGOFF
Assistant Chief Engineer
Burndy Engineering Company, Inc., New York

Among the applications of flat, flexible copper braid in the electrical industry are its uses to compensate for expansion or contraction of tubular, channel or flat bar bus runs; to prevent breakage of insulators or bushings because of settling substation foundations; to provide current by-passes for moving electrical parts of heavy machinery or equipment; to ground movable switch handles; to absorb shock, and for numerous other purposes.

* Republication rights reserved by Burndy Engineering Company, Inc.

Not finding complete data available on the alternating-current carrying capacities of flexible braid, particularly when multiple braids are used as conductors, Burndy Engineering Company, Inc., recently completed an extensive series of tests. The three sizes of braids for which test results are shown in the accompanying table each consisted of groups of tinned copper strands woven into tubular form and flattened. The heavier braids consisted of groups of strands woven into three concentric tubes and flattened, thereby forming a three-layer braid.

It is interesting to note that in the case of small groups—less than four—of unspaced braids, the major axis of the composite conductor remains in the same plane as that of the individual braids and the vertical braids carry more current than the horizontal braids for the same temperature rise. However, in the larger groups, the axis of the composite conductor is perpendicular to that of the individual braids and the horizontal braids carry the greater current.

**Braid Dimensions**

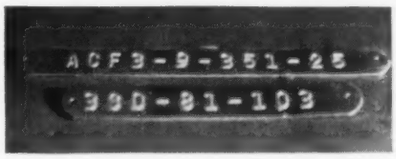
| Type | Cross-Sectional Area in Circ.mil | Individual Strand Sizes, No. | No. of Strands in Each Group | No. of Groups in Each Layer | No. of Layers in Each Braid |
|---|---|---|---|---|---|
| BB077 | 76,800 | 30 AWG | 32 | 24 | 1 |
| BB300 | 302,300 | 30 AWG | 42 | 24 | 3 |
| BB154 | 153,700 | 30 AWG | 32 | 48 | 1 |

| | Position & Spacing | Type | Number of braids in group | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | VERTICAL UNSPACED | BB 300 | 415 | 625 | 835 | 1035 | 1220 | 1390 | 1535 | 1655 | 1760 | 1840 |
| | | BB 154 | 340 | 440 | 540 | 640 | 740 | 835 | 920 | 1010 | 1080 | 1140 |
| | | BB 077 | 190 | 280 | 360 | 435 | 510 | 565 | 605 | 635 | 650 | 665 |
| | HORIZONTAL UNSPACED | BB 300 | 390 | 615 | 840 | 1060 | 1265 | 1460 | 1625 | 1775 | 1885 | 1985 |
| | | BB 154 | 305 | 420 | 530 | 640 | 740 | 840 | 935 | 1010 | 1070 | 1115 |
| | | BB 077 | 185 | 270 | 350 | 425 | 500 | 570 | 625 | 670 | 695 | 710 |
| | HORIZONTAL ¼" SPACE BETWEEN BRAIDS | BB 300 | 390 | 690 | 990 | 1290 | 1580 | 1880 | 2170 | 2430 | 2700 | 2930 |
| | | BB 154 | 305 | 475 | 675 | 870 | 1060 | 1250 | 1440 | 1620 | 1780 | 1950 |
| | | BB 077 | 185 | 320 | 470 | 615 | 760 | 900 | 1040 | 1180 | 1310 | 1420 |
| | VERTICAL ¼" SPACE BETWEEN BRAIDS | BB 300 | 415 | 775 | 1140 | 1490 | 1815 | 2100 | 2340 | 2540 | 2700 | 2825 |
| | | BB 154 | 340 | 620 | 875 | 1140 | 1375 | 1570 | 1740 | 1870 | 1970 | 2025 |
| | | BB 077 | 190 | 380 | 575 | 775 | 950 | 1085 | 1200 | 1290 | 1350 | 1400 |

**ALTERNATING-CURRENT carrying capacity (in amperes) of flexible copper braids for 30 deg. C. temperature rise, frequency 60 cycles**

## Pole Tag System Shows Fuse Locations

Like many electric utilities, Wisconsin Gas & Electric Company, Racine, some time ago faced the problem of identifying the exact location of three-shot fuses, solid disconnects, fused cutouts, etc., on distribution circuits by some designation that could be used in issuing orders to linemen.




**TAG SYSTEM identifies fused switch and gives location by township, section and customer—fuse size, too**

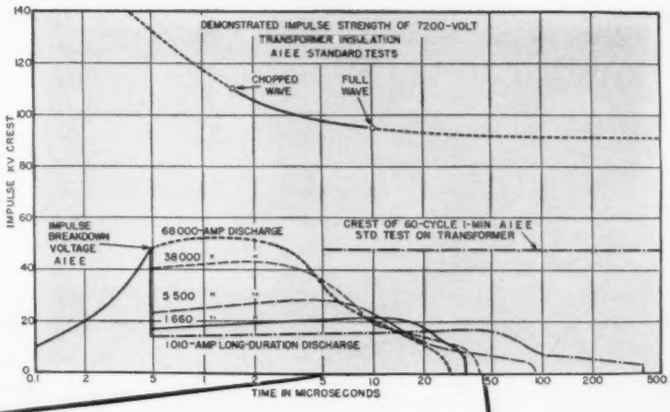
In developing the illustrated pole tags company engineers made use of political subdivisions in the territory served to identify specific equipment. Thus, the larger of the two pole tags shown, reading from left to right, reveals the following information: A and C phase, three-shot fuse—township 9—section 35, customer 1—25 amp. fuse. The smaller tag would be read as follows: Three solid disconnects—township 81—section 10, customer 3, no fuse is needed.

From these examples it is seen that the first group of numbers and letters identifies the type of equipment and phases to which it is connected. Group two identifies the township. First two integers of group three identify the section. Remaining in-

# You Get A Big EXTRA MARGIN OF PROTECTION with MODERN Pellet Arresters

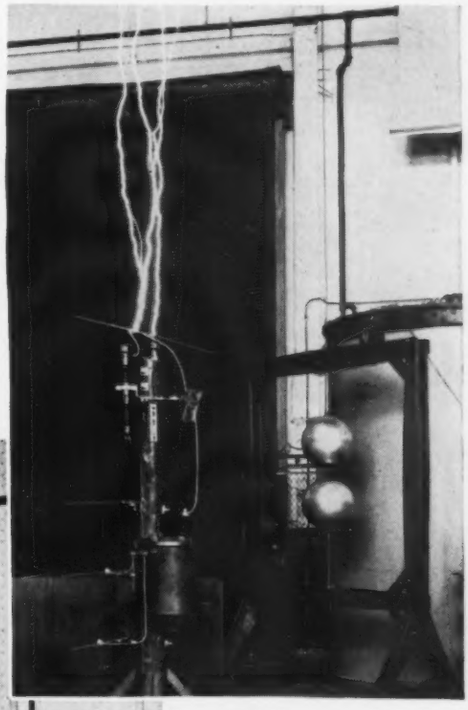
***Even with severe lightning discharges, pellet arresters limit stresses to less than half the impulse test strength of the distribution transformer***

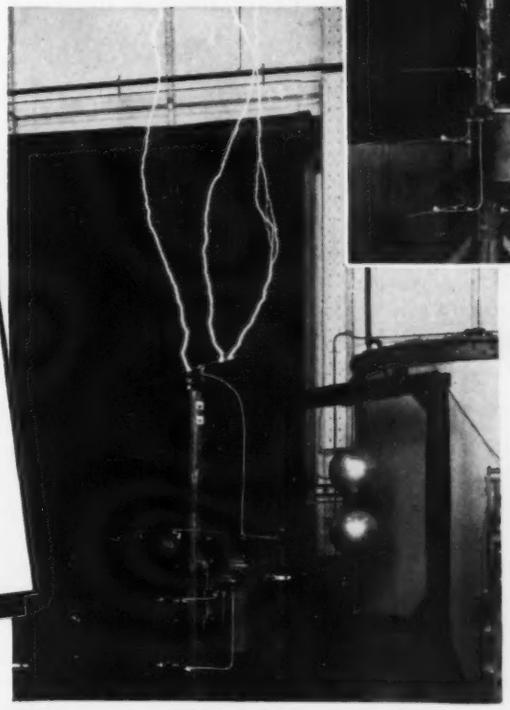
## HERE'S PROOF OF THAT EXTRA MARGIN OF SAFETY. . .


DEMONSTRATED IMPULSE STRENGTH OF 7200-VOLT TRANSFORMER INSULATION A I E E STANDARD TESTS
CHOPPED WAVE
FULL WAVE
IMPULSE KV CREST
IMPULSE BREAKDOWN VOLTAGE A I E E
68000-AMP DISCHARGE
38000 " "
5500 " "
1660 " "
1010-AMP LONG-DURATION DISCHARGE
CREST OF 60-CYCLE 1-MIN A I E E STD TEST ON TRANSFORMER
TIME IN MICROSECONDS

In this graph, the impulse volt-time oscillograms of the 9-kv pellet arrester are compared with the volt-time impulse test strength of a 7200-volt distribution transformer

## . . . AND YOU ALSO GET EXTRA LARGE DISCHARGE CAPACITY





Pellet arresters mounted separately (above) or directly on transformer (left) withstand severe lightning strokes. Pellet arresters have discharge capacity in excess of the highest lightning discharge currents measured on distribution circuits.*

*See "*Discharge Currents in Distribution Arresters,*" Electrical Engineering, June, 1938.

### The Extra Values in Pellet Arrester Protection

1. You avoid repeated stresses close to the transformer strength.
2. You have plenty of margin of protection, even assuming considerable depreciation of transformer insulation with years of service.
3. You get excellent protection for your old transformers as well as for new ones.
4. You can expect the maximum life from your transformers.

**NO NEED TO GAMBLE . . .** ***Get the important extra margin of protection for your distribution transformers by specifying G-E pellet arresters. Select them from Bulletin GEA-2975. General Electric Company, Schenectady, N. Y.***

GENERAL ELECTRIC

tegers in the third group are the customer number. Last number group is fuse link size.

In villages the two center number groups are eliminated and in their place is stamped the town name and the installation number; fuse size follows this. Tags are attached to foot of poles so linemen can quickly determine the size fuse to be taken up.

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## Cost of Improving a Substation

From the data sheets of an Eastern utility are taken the following field construction costs of installing two 24-kva. induction voltage regulators and 48 ft. of chain link fencing in a substation serving a small city on the system. The work was done between October and December, 1939, at a total outlay of $3,535.35.

| | |
|---|---|
| Labor | $154.96 |
| Liability insurance and payroll tax | 8.25 |
| Engineering, superintendence, timekeeping, field office | 817.45 |
| Stores expense | 23.39 |
| Two 24-kva. induction regulators | 2,232.47 |
| Three 400-amp. disconnecting switches | 45.00 |
| Three lightning arresters | 16.56 |
| 188 lb. triple-braid, weatherproof No. 4/0 wire | 27.26 |
| 40 ft. No. 4 rubber-covered 600-volt wire | 1.20 |
| 4 ft. 500,000-c.m. flameproof wire | 3.36 |
| 12 dead-end insulators | 10.44 |
| 48 ft. chain link fencing, gate and nine posts (7 ft. high); 4-ft. gate | 73.00 |
| 50 ft. of 1 x 1/8-in. steel | 3.50 |
| Cement, gravel and stone | 21.09 |
| Miscellaneous | 97.42 |
| Total | $3,535.35 |

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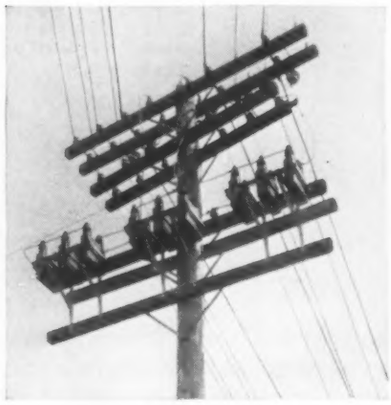
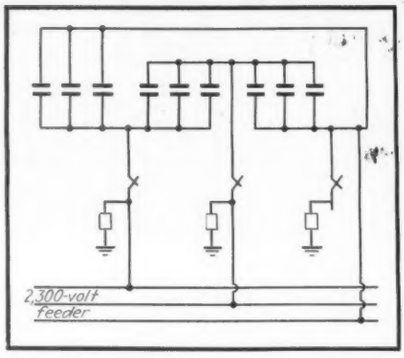
## Capacitors Earn Fourteen Times Cost

An investment of approximately $9,000 in pole-type capacitors on the Fitchburg (Mass.) Gas & Electric Company's system during the past three years has released for service investments approximating $125,000 and raised the system power factor from 76 per cent to something over 86 per cent.



**135-KVA. pole-top installation across 2,300-volt feeder circuit**




**CONNECTIONS of capacitor bank where cutouts and lightning arresters are used**

By employing capacitors and some local load transfer to other substations the kilowatt load on the 6,000-kva. substation has remained practically constant and the kva. load cut from 5,750 to 4,500, releasing one 1,500-kva. substation transformer bank as a spare.

Similarly, load on four outgoing station distribution feeders has been reduced below the total designated capacity of 4,800 kva., leaving spare capacity for additional loads. Without the use of capacitors an additional 2,300-volt distribution circuit would have been required three years ago, so that capacitor installation has already deferred this investment, with the attendant savings in fixed charges thereon.

Kva. load on one substation bank of 3,000-kva. rating has been reduced to a point well within the capacity of the bank, even though one transformer be out of service. Likewise, the kva. load on three parallel transmission cable circuits has been reduced to a point below the two-hour emergency rating of two cables, so that one is available for spare under emergency conditions.

The substation, transmission and distribution capacity restored to active use for additional revenue production—*i.e.*, load-carrying ability—was some 1,200 kva. The capacitors cost about $9,000 installed and the substation, transmission and distribution facilities released for service represent an investment of about $60,000. Beyond this was an attendant advantage which in itself would have been of sufficient importance to warrant the installation, because each kva. in capacitors installed freed generating capacity of like amount. It is estimated that the total service investment released by the capacitor installation reached $125,000.

It was found most economical to utilize G. E. pole-type capacitors of 15-kva. unit rating. These were installed between the transformer fuse and the distribution transformer in most cases. In two instances installations of 90 kva. each were used with cutouts and lightning arresters.

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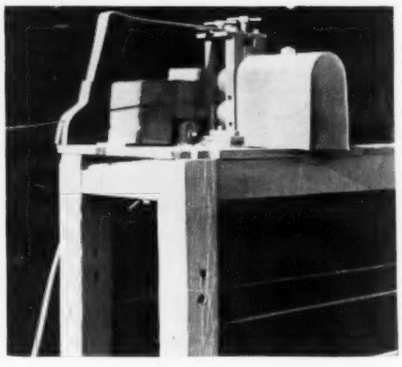
## Salvage Copper Wire With New Stripper

Nearly $1,000 worth of weatherproof wire heretofore burned to remove the insulation and then sold for junk was salvaged last year by the Arkansas Power & Light Company through use of a new wire-stripping machine which has a capacity of approximately 1,200 lb. of No. 6 wire per day.

Eugene K. Tedstrom, division storekeeper for the utility at Pine Bluff, Ark., who developed the machine, got the idea by watching a service man prepare a piece of covered copper wire for splicing by squeezing the end between the handle of his pliers.



**WIRE-STRIPPING MACHINE can salvage 1,200 lb. of No. 6 wire a day**

The stripping machine was constructed from miscellaneous scrapped materials and is powered by a 1-hp. motor. The two 3-in. rollers, which press the insulation from the wire, revolve at 90 r.p.m. and are adjustable to practically any size wire. As the wire leaves the rollers it passes through a groove in an extension arm which removes all of the insulation. Including labor and materials, the machine involved a cost of slightly more than $150. Since it has been put into use repair crews removing weatherproof wire have been asked to eliminate cutting it as much

# Millions of Dollars Will Be Saved

THE Spirakore design, by utilizing core steel much more efficiently than conventional L-punching cores, has brought a basic reduction in the price level of distribution transformers. Over the years, this development will mean annual savings running into the millions in the cost of distributing electrical energy.

The improvements in performance, while harder to evaluate, will also result in material savings in operating costs.

The introduction of the Spirakore transformer, more than three years ago, brought a reduction of 11½ to 18 per cent in the prices of the first Spirakore ratings available, the 1½- and 3-kva sizes.

Our aim has been to extend the Spirakore design as soon as possible to transformers throughout the distribution range—in order that the electrical industry might benefit from the manufacturing economies made possible by Spirakore. Today, all ratings of G-E transformers up to 500 kva are rapidly being changed over to the Spirakore design. And, as the result of a series of price adjustments, the market levels of distribution transformers being sold today average 15 to 20 per cent less than in the period just before Spirakore. General Electric, Schenectady, N. Y.

***Specify Spirakore transformers—designated TYPE HS***

**GENERAL ELECTRIC**

402-27-5100

as possible in order that maximum lengths can be used in the stripping process.

Mr. Tedstrom estimates that between 15,000 and 20,000 lb. of scrap copper wire returned to the storeroom annually can be salvaged at savings of from $1,100 to $1,500. After the wire is stripped at the storeroom it is spliced and rolled into coils. Cost of this splicing and reeling is included in the costs of stripping, making the saving estimated include these costs.

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## Prefabricated Sleeve for 5-Kv. Splice

By N. J. BUKEY
Underground Department,
Cincinnati Gas & Electric Company

A high failure rate on 4-kv. potheads has caused the Cincinnati Gas & Electric Company to adopt single-conductor, rubber-insulated cables of the "Kerite" type for use on terminal poles.

The point where the four-conductor, paper-insulated cable joins the single-conductor, rubber-insulated cable requires a branch splice of special construction.

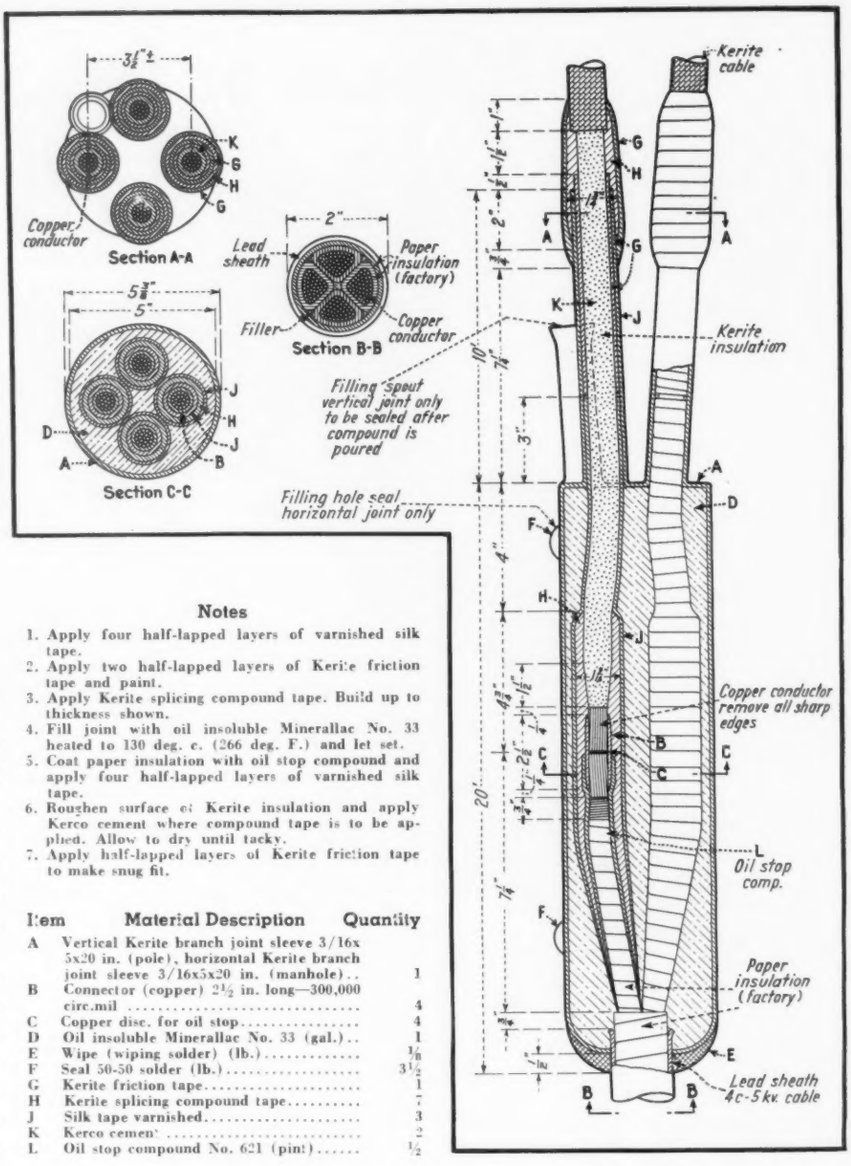
A prefabricated lead sleeve has been developed for this joint which gives a more satisfactory job and at the same time simplifies construction. The sleeve consists of a $\frac{3}{16}$x5x20-in. lead sleeve into one end of which four 1x10-in. lead sleeves are fitted by lead burning. On sleeves which are to be used in the vertical position, as on a pole, an extra pipe is placed for the purpose of filling the splice with compound. This assembly can be easily fabricated by any competent lead burner.

This type of construction has definite advantages over the normal wiped joint:

1. A complicated four- or five-way wipe is eliminated.
2. Possibility of damage to the rubber-insulated cables caused by the heat from the wiping process is eliminated.
3. Considerable time is saved on the job. This is particularly important in cases where there is a changeover on an existing circuit to the new type of construction.

Internal construction of the splice is similar to standard joints of the same general type. The copper conductors are sweated together in the usual manner, except that precautions are taken to prevent the transfer of cable oil through the joint. Varnished silk tape with oil-stop compound is applied over the paper insulation. The applied insulation consists of a special rubber tape and is covered with four layers of varnished silk tape. Oil-stop compound is used between the outer layers. The joint is filled with an oil-resisting compound.

Junction of the small lead sleeves with the rubber cables is waterproofed with rubber tape covered with friction tape and rubberoid paint applied over it.

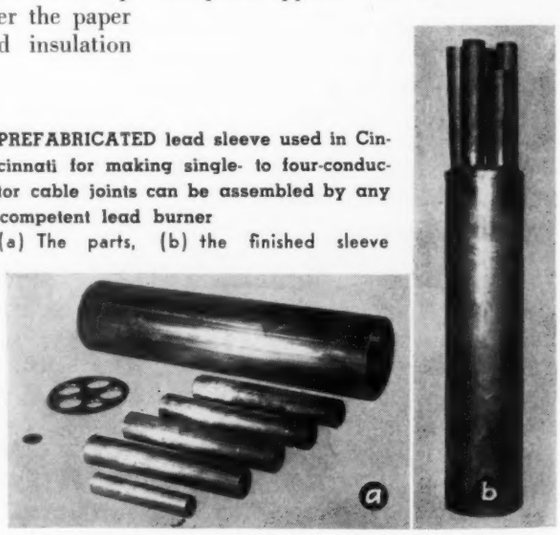



**Notes**

1. Apply four half-lapped layers of varnished silk tape.
2. Apply two half-lapped layers of Kerite friction tape and paint.
3. Apply Kerite splicing compound tape. Build up to thickness shown.
4. Fill joint with oil insoluble Minerallac No. 33 heated to 130 deg. c. (266 deg. F.) and let set.
5. Coat paper insulation with oil stop compound and apply four half-lapped layers of varnished silk tape.
6. Roughen surface of Kerite insulation and apply Kerco cement where compound tape is to be applied. Allow to dry until tacky.
7. Apply half-lapped layers of Kerite friction tape to make snug fit.

| Item | Material Description | Quantity |
|---|---|---|
| A | Vertical Kerite branch joint sleeve 3/16x 5x20 in. (pole), horizontal Kerite branch joint sleeve 3/16x5x20 in. (manhole) | 1 |
| B | Connector (copper) 2½ in. long—300,000 circ.mil | 4 |
| C | Copper disc, for oil stop | 4 |
| D | Oil insoluble Minerallac No. 33 (gal.) | 1 |
| E | Wipe (wiping solder) (lb.) | ¼ |
| F | Seal 50-50 solder (lb.) | 3½ |
| G | Kerite friction tape | 1 |
| H | Kerite splicing compound tape | 7 |
| J | Silk tape varnished | 3 |
| K | Kerco cement | 2 |
| L | Oil stop compound No. 621 (pint) | ½ |

**DETAILS of 5-kv. branch splice between No. 4/0, four-conductor, lead-covered, paper-insulated cable and four 300,000-circ.mil, single-conductor Kerite-insulated cables. Splice can be either horizontal or vertical**




**PREFABRICATED lead sleeve used in Cincinnati for making single- to four-conductor cable joints can be assembled by any competent lead burner**
**(a) The parts, (b) the finished sleeve**

# WHY MAGNETIC STABILITY?

ONE absolute necessity for maintained watthour-meter accuracy is a magnet that is dependable. Therefore, our engineers decided to use alnico magnets only after they had developed a design which conclusive tests proved to be magnetically stable.

To obtain maximum benefit from the advantages inherent in alnico, the mechanical construction must be absolutely permanent. That is why G-E alnico magnets have an all-welded, one-piece construction.

Added safeguards to magnet permanence are the stabilizing treatments given to prevent changes in strength with age. Each step in the manufacture of G-E alnico magnets has been developed and is controlled to assure the permanency of accurate registration — under conditions of widely varying loads and temperatures — which has always been typical of the I-30 line of watthour meters.

*General Electric Co., Schenectady, N. Y.*

**GENERAL ELECTRIC**

601-6-6110

# INDUSTRIAL ENGINEERING

## Light Car Interiors to 20 Foot-Candles

In relighting an assembly line where interior trim is added to automobile bodies as they move along a 2,750-ft. conveyor engineers of the Seaman body division of Nash-Kelvinator Corporation, Milwaukee, made exceptionally good use of modern fluorescent equipment in meeting a difficult industrial lighting situation.

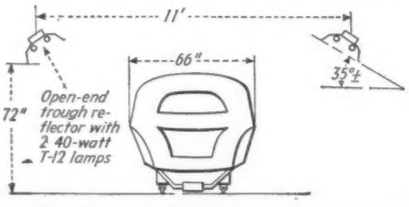
Proper seeing conditions for the trimming operation required that the interior of the cars be lighted to an intensity of 20 foot-candles and, because the work was close, uniform illumination, free from high spots and shadows, was desirable. Obviously, light had to come from outside the car.

Incandescent lamps in angle reflectors spaced along the assembly line, at approximately 4-ft. intervals, had been used until recently. In spite of a relatively close spacing, illumination within the car varied widely as it moved down the line past each reflector.

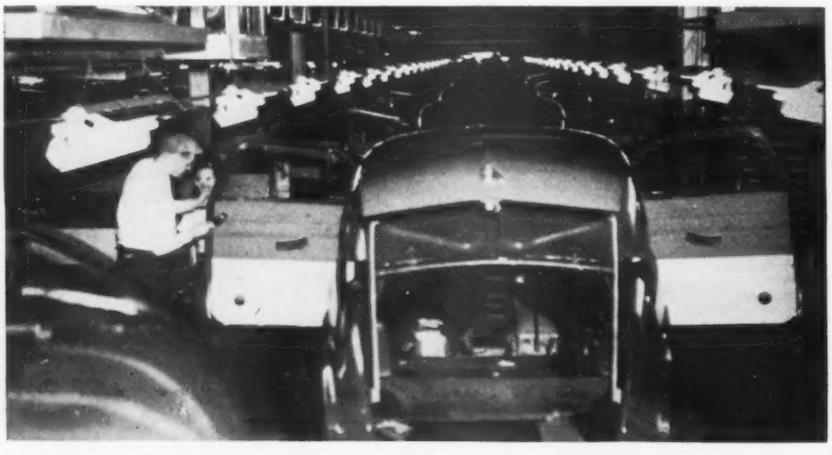
Length of the new 48-in. fluorescent lamps and their high lumen output made them an obvious selection for this task. By mounting two white 40-watt, 48-in. T-12 fluorescent lamps in 54-in. long, open-end, trough-type reflectors and spacing them their own length apart on straight sections of the assembly line the necessary 20 foot-candles inside the car was obtained. Lights on the right side of the line are opposite the space of the left side.

Because the light from the lamps had to be directed through the side windows and open doors of the cars as they passed along the line mounting of the fixtures was given close attention. Fixtures were mounted 6 ft. from the floor and far enough out from the center of the production line so that a 66-in. wide car body, with doors open, could pass and still leave room for men to move about between them. With these two dimensions determined it was found that by tilting the fixture at about 30-35 deg. with the horizontal the maximum amount of light was directed into the car. About 200 fixtures were required for the 750-ft. inside-trim section of the 2,750-ft. conveyor line.

This type of lighting is used throughout the body plant where assembly and fabrication of parts are in shadow areas or where cloth cutting, sewing or installation is involved. All inspection of finished bodies is completed in fluorescent-lighted areas.




**MOUNTING DETAILS for fluorescent fixtures on auto assembly line**



**TILTED fluorescent fixtures along automobile assembly line light car interior to 20 foot-candles for trimming operation. The 200 fixtures each house two 40-watt, 48-in. white fluorescents**

## Safeguarding Transformers in Yard

In a Bay State industrial establishment where it was desired to utilize interior space to the maximum and save copper in lighting and small power circuits major sections of the shop are supplied with energy for lighting by transformer units located at the ground level outside the walls. These units are served by 600-volt, three-phase feeders from a central substation, short runs of 120/240-volt circuits being carried from the transformers to control cabinets inside the walls before entering upon the internal distribution.

# What Do YOU Look for in a Street-lighting Luminaire?

### PROPER LIGHT DISTRIBUTION?

You have it, without disturbing glare, when you use the Forms 79S, 79D, and 79R — because their deep-shading reflector delivers more illumination on the pavement than the best of previous luminaires. The Form 79S gives a symmetrical distribution; aluminum deflectors within the globe of 79D's redirect a large portion of the house-side light on the roadway. But, if you want highest efficiency, use 79R's with the Holophane refractor globe—they're unequalled.

### LOW INITIAL COST?

For the money you would pay for an ordinary luminaire you can obtain a Form 79 with spun-sealed glassware, weatherproof joint between hood and reflector, lamp-saver reflector, and seven other "plus" features. Production-line manufacturing, made possible by the widespread demand for this luminaire—installations have been made in all 48 states—means more for your street-lighting dollar.

### SUSTAINED EFFICIENCY?

General Electric's Form 79, you can be sure, will maintain its original efficiency. There will be no collection of insects and dirt within the globe to trap a large part of the light. Because the only joint in the luminaire is between the hood and reflector where an accurate die casting fits against a die-formed shoulder, users report that reflectors inspected after years of service have been found absolutely clean.

### EASY SERVICING?

Release the tension on two snap-action latches, lift them off the hood lugs, let the reflector hang by the safety chain—in less time than it takes to unbutton your coat the lineman has opened the luminaire for servicing. Relamping, replacing broken glassware, cleaning—all can be done easily on the job.

### ATTRACTIVE APPEARANCE?

Smooth flowing lines, the absence of gingerbread on the hood, liberal use of die-cast and punch-press parts —all share in making Form 79's clean-cut and attractive. Many prefer the natural-aluminum finish of both reflector and hood. Others use our standard —a glossy, dark-green, Glyptal-enamel finish. Where the effect of a much larger luminaire is desired, the longer No. 207 globe is available at no additional cost.

### MINIMUM MAINTENANCE EXPENSE?

More than six years ago when glassware breakage was a regular occurrence, General Electric introduced the Form 79 with spun-sealed globe and said—"glassware replacement will be about 10 cents a year." Apparently we were too conservative; one utility reports only 4.63 cents per luminaire a year, another has 134 Form 79's and recently asked for information on one replacement globe—*their first breakage in three years.* These low records were made possible by spinning the reflector to the globe to protect the edge against chipping and damage. And the stepped reflector—the lamp-saving feature that redirects radiant energy slightly to one side of the lamp stem—has a share in keeping maintenance low.

**You want a luminaire that meets today's most exacting demands for complete reliability, sustained economy, and effective illumination. Citizens in your community want safer, better-lighted streets. That is why more and more electric service companies and cities all across the country are buying Form 79's. Can we help you? General Electric, Schenectady, N. Y.**

**GENERAL ELECTRIC**

452-13-3010

A typical unit, rated at 50 kva., is mounted on 2½-in. steel channels resting on a concrete slab and is screened in on top, front and sides by a cage 4 ft. 8 in. long x 3 ft. 5 in. wide x 4 ft. 4 in. high, the framing being of 1⅝-in. and 1⅜-in. channels and angles, to which the screening is electrically

**PIPE STANDARDS and screening protect lighting transformer and employees**

welded. Protection against truck movements is insured by two 4½-in. diameter pipe standards 3 ft. 2 in. high, 5 ft. 4 in. on centers and 15 in. in front of the cage. The 600-volt feeder is brought into the cage by underground duct and from a riser carrying a pothead the primary leads are extended to the bushings of the transformer, secondary connections being looped from the low-tension bushings to a conduit fitting, from which a pipe duct passes through the wall into the shop. A ¾-in. wide ground strap connects the transformer casing with the secondary conduit.

## Safety Featured in Tipple Distribution

The latest ideas for safety and low maintenance are incorporated in the electrical distribution system of the tipple for Tecumseh Coal Corporation's new strip mine near Dickeysville, Ind. (see page 72).

The tipple load, which totals 1,800 hp., and is approximately 50 per cent of the total mine load, including the electric stripping (1,275 hp.) and loading (275 hp.) shovels, is supplied from the tipple substation. This substation is supplied from pit substation. Because of the coal dust and corrosive fumes always present around a tipple, 46-kv. bushings are used on the 33-kv. transformer and 46-kv. insulators on all bus supports and disconnecting switches on the 33-kv. circuits.

Power for the tipple is obtained from the 480-240-volt side of the 33-kv., 2,000-kva., three-phase, delta-delta connected transformer bank, consisting of three 667-kva., single-phase units and one spare 667-kva. unit. Lighting for the tipple is obtained from the low-voltage side of a 50-kva., 480/240-120-volt, single-phase transformer on the outdoor substation structure. No hand picking of coal is necessary, consequently no special units are required.

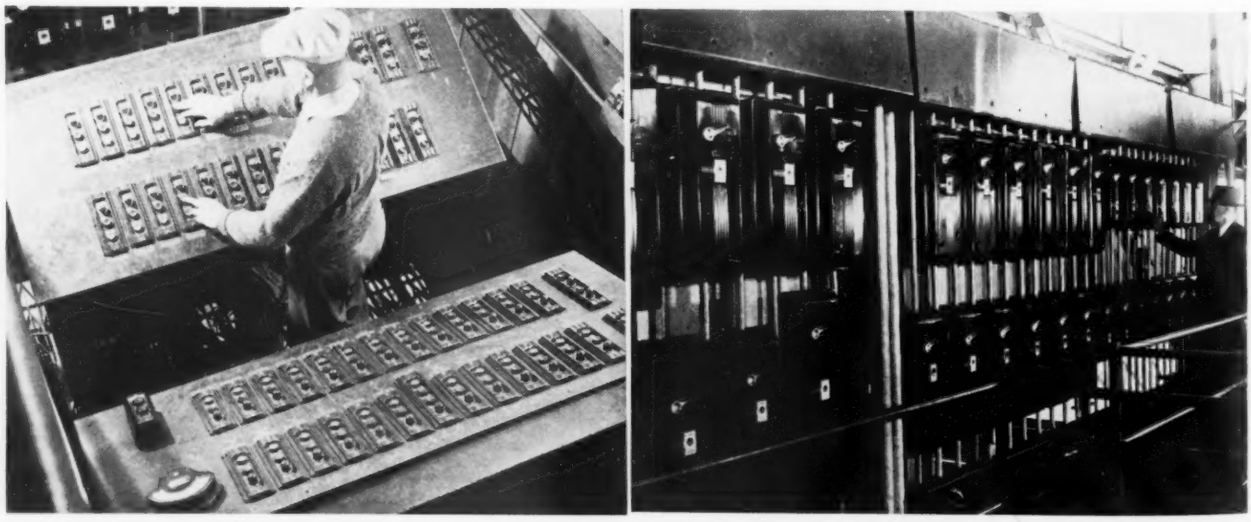
Low-voltage power and lighting cables are run underground from the tipple substation 150 ft. to the tipple building. Six 500,000-circ.mil cables per phase are used for power and three No. 4/0 cables for lighting. All underground cables are 1,000-volt, Anhydrex AA-60. Intercommunicating telephone lines are run in the same trenches with the power cables and are of the same type wire, but with 600-volt insulation.

Main power distribution center for the tipple is a self-supporting, entirely steel-inclosed vertical switchboard with three Westinghouse 800-amp., three-pole, single-throw, manually operated oil circuit breakers provided with time-delay overload protection.

### *Load Centers*

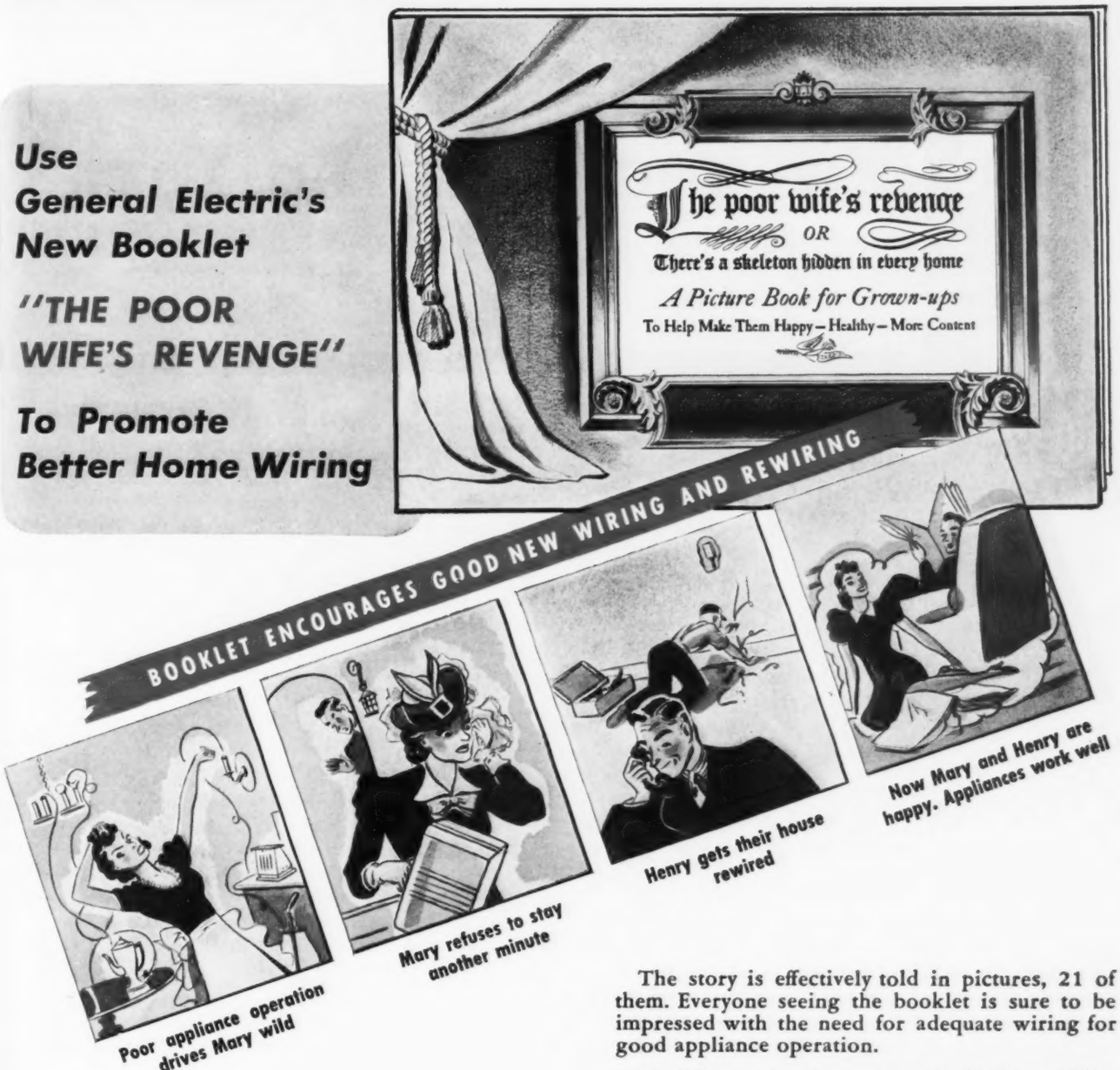
The three circuits leaving the power distribution switchboard are carried in conduits to three groups of magnetic motor starters, which in turn are controlled from three sloping bench-type control boards on which are mounted groups of push buttons, each with one red indicating lamp. Each group of magnetic starters has a steel-inclosed bus run at the top and a steel pull box at the bottom of the group.

No fuses are used in the power or control circuits throughout the tipple. Thermal overload protection is afforded by individual magnetic motor-starting switches. At each crusher motor there is a quick-make-and-quick-break unfused safety switch. All electrical connections are made with stranded wire run in galvanized iron conduit; No. 12 wire is the smallest used. Electric wiring of the tipple was done by the Swanson-Nunn Company, Evansville, Ind.



**THREE sloping bench-type control boards (left) provide remote control for three groups of magnetic motor starters (right) in tipple building. Steel-inclosed busbars are located above the group of starters and wiring troughs below. The tipple contains 78 motors—exclusive of motors on heating units—which range in size from ¾ to 150 hp.**

## Use General Electric's New Booklet "THE POOR WIFE'S REVENGE" To Promote Better Home Wiring


The poor wife's revenge
OR
There's a skeleton hidden in every home
A Picture Book for Grown-ups
To Help Make Them Happy – Healthy – More Content
BOOKLET ENCOURAGES GOOD NEW WIRING AND REWIRING
Poor appliance operation drives Mary wild
Mary refuses to stay another minute
Henry gets their house rewired
Now Mary and Henry are happy. Appliances work well

Here's a booklet that you can use to advantage in interesting your domestic customers in better home wiring. It emphasizes the fact that wide use of appliances depends on good wiring.

The booklet will also be welcomed by builders of new houses and by everyone interested in making homes more comfortable and convenient.

"The Poor Wife's Revenge" tells the dramatic story of the Higglespoons. Their home was breaking up. Mary was driven to distraction by electrical appliances that wouldn't work. Just in the nick of time Henry found that better wiring would give their appliances the power they needed.

The story is effectively told in pictures, 21 of them. Everyone seeing the booklet is sure to be impressed with the need for adequate wiring for good appliance operation.

Send the coupon for copies of "The Poor Wife's Revenge" to distribute in your territory. It is available free in quantities of 250 or less. Larger quantities are available at $1.00 per hundred.

General Electric Company
Section CDW-194
Appliance and Merchandise Dept.
Bridgeport, Conn.

Sirs: Please send me.....copies of "The Poor Wife's Revenge."

*Name* .....

*Address* .....

*City*.....*State*.....

**GENERAL ELECTRIC**

# NEW ENGINEERING IDEAS

## Charts Prove Helpful in Adequate Wiring

By CHARLES F. CAMERON
Electrical Engineer, Rock Springs, Wyoming

Wiring installations generally constitute a bottleneck to the electrical industry.

Relatively little seems to have been done with the problem of finding the most appropriate size of wire for circuits in buildings. If the wire is small the resistance is comparatively high, as likewise is the power loss. The consumer pays for this loss. On the other hand, if the conductor size is increased the cost of the power loss is decreased, but the interest, taxes, insurance and depreciation have increased. Between these two extremes there is an optimum wire size which should be used.

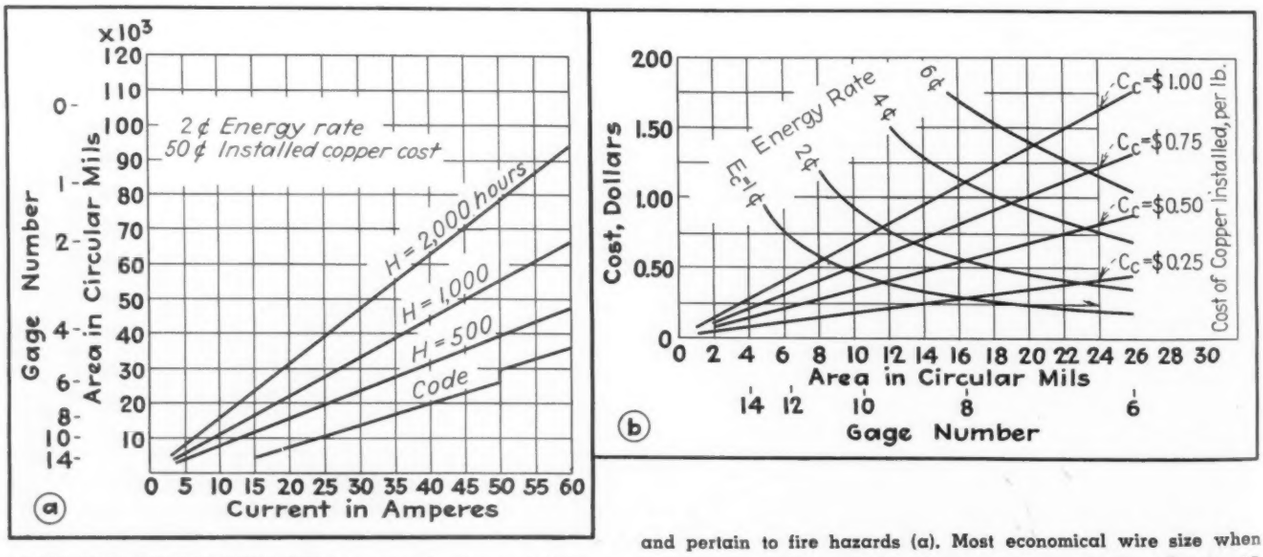
The cost per year of the resistance loss in a circuit is $I^2RHE_c/1{,}000$, where $I$ is the current, $R$ is the resistance of the circuit, $H$ is the hours per year that the circuit is used and $E_c$ is the rate paid for electrical energy per kilowatt-hour.

The first cost of the circuit depends upon the length of wire, the wire size, the cost per pound and the labor cost for installing the circuit. Assuming 11 per cent of the first cost sufficient to cover interest, taxes, insurance and depreciation, then this represents a fixed charge against the circuit. The wire size which corresponds to a minimum annual cost may be found. The $I^2R$ loss may be changed to a relation involving length and area by substituting $R = 10.4\ L/A$. Then energy cost per year $= 0.0104\ I^2LHE_c/A$. Cost of wire $= 3.03 \times 10^{-6}LAC_c$ where $L$ is the total length of the circuit, $A$ is the area of the wire in circular mils and $C_c$ is the cost of copper per pound installed. When the fixed charge against the circuit is taken as 11 per cent, then the annual charge will be 11 per cent of the wire cost, or annual wire charge $= 0.333 \times 10^{-6}LAC_c$. The sum of these two variable costs represents the total cost as determined by the wire size. If the derivative of this sum is equated to zero, the resulting value of $A$ will give the condition for minimum cost. This conductor section may be called the most economical wire size. The equation is

$$A = 176.6\ I\ \sqrt{H\ E_c/C_c}$$

In the second set of curves for the most economical wire size the intersection of an $E_c$ curve and a $C_c$ curve gives a solution of the equation for the most economical wire size. It will be noted that for a 4-cent energy rate and cost of $1 per pound of copper installed the most economical wire size is found to be No. 8. The Code calls for No. 14 wire. Current of 45 amp. was chosen with this in view.

This chart should be invaluable and pertain to fire hazards (a). Most economical wire size when energy rate and installed cost of copper are known. Current 15 amp. Circuit (length 100 ft.) used 1,000 hours per year (b)




MOST ECONOMICAL WIRE SIZE for several values of hours per year operation. Code requirements as shown are minimum

in proving to a builder that it is necessary to install copper of sufficient size if true economy is to be obtained. It eliminates the tendency of making loose statements about adequate wiring and substitutes a graphical solution for the different variable parameters.

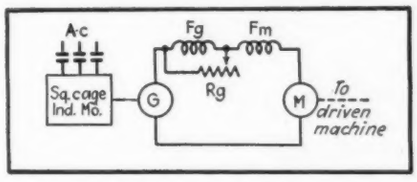
•

## Adjustable-Speed Unit Needs No Exciter

By S. H. HANVILLE
Motor Engineer, Westinghouse Elec. & Manufacturing Company, East Pittsburgh, Pa.

High-torque characteristics of a d.c. series motor are combined with flat-speed characteristics of a shunt machine in a newly developed series adjustable-speed a.c. drive, which uses the variable-voltage principle but employs a series circuit that requires no exciter.

Basically, the drive consists of

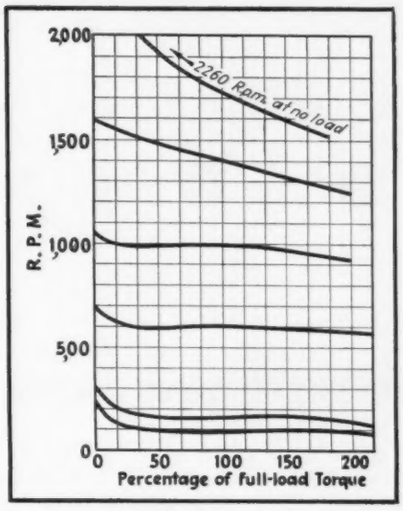



**NO EXCITER is needed for this newly developed a.c. adjustable speed drive, in which the armatures and fields of generator and driving motor are in series**

When rheostat ($R_g$) has maximum resistance, current through generator field ($F_g$) is maximum. Thus generator voltage is maximum and motor ($M$) runs at maximum speed. As resistance is decreased, generator field is weakened, generator voltage drops and speed of motor ($M$) decreases proportionally.

three units, instead of four: (1) A squirrel-cage induction motor operating from an a.c. power source and mounted in the same frame with and driving a series d.c. generator which supplies operating voltage for (2) a series motor connected to the driven machine. For speed control there is (3) a low-resistance field rheostat. Only additional equipment required is a starter and push button for the squirrel-cage motor.

Because the exciter is eliminated, operation of the drive, though similar in principle to the conventional variable-voltage drive, is somewhat simpler in practice. Pushing the "start" button closes the starter contactor, the motor-generator set comes up to speed and the d.c. driving motor starts. Since voltage output of the




**HIGH-TORQUE, FLAT-SPEED characteristics are combined in the series adjustable-speed drive**

Units are suitable for continuous operation at speeds of from 1,750 to 175 r.p.m. at constant torque, without exceeding safe temperature rise, though this speed range may be extended to 20 to 1 for short-time operations such as setting up and threading. Curves shown are for a 10-hp. unit.

self-excited generator builds up gradually under normal starting conditions, the driving motor is cushioned against shock. If the motor stalls it can produce a torque equal to six or eight times full-load running torque, even at minimum speed.

If the application requires it, dynamic braking and inching can be incorporated in the circuit without using an external braking resistor. Typical applications of the units, which are available in 1 to 15 hp. ratings, are a 10-hp. unit on a printing press, a 10-hp. lathe drive and a 1½-hp. unit driving a bottle-making machine. The drive is not intended to replace conventional drives for applications such as planers, shapers, steel mills and similar machinery requiring fast reversals, regenerative braking or accurate stopping.

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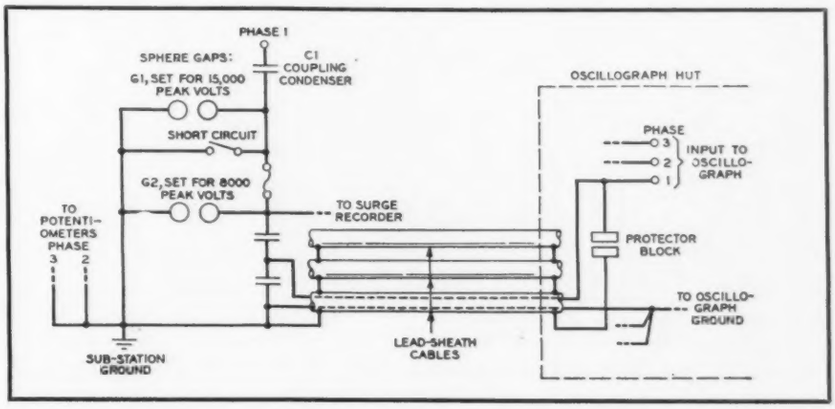
## Three-Beam Tube for Three-Phase Studies

Investigation with the automatic cathode-ray oscillograph of the inductive effects on telephone lines of overvoltages on a three-phase power system, conducted by the joint subcommittee on development and research of the Edison Electric Institute and the Bell System, called for three recording elements, one for each phase.

This led to the choice of the Western Electric 330C cathode-ray tube, a recent development of the Bell Laboratories, in which three complete units are inclosed in a single glass element. Thus was obviated the need for three separate tubes with the accompanying increase in bulk and complication of the photographic system.

The line-to-ground voltages of a three-phase system are applied to the deflecting plates through networks providing a balanced input, essential because a well-focused beam is maintained only when the pair of plates is balanced with respect to the potential of the accelerating electrode. The other pair of plates in each group is connected to the sweep circuit to resolve the wave shape on the fluorescent screen.




**THREE-BEAM cathode-ray tube simplifies overvoltage studies on three-phase system**

Line-to-ground voltages of each phase 44-kv. system are applied to one set of deflecting plates of tube. Capacity potentiometers reduce voltage to value suitable for oscillograph. Protective equipment is designed so that gap $G_2$ will break down if condenser $C_1$ fails. Resultant current will open fuse and gap $G_1$ will ground system until it is cleared by circuit breakers. Protector blocks and grounding of oscillograph case furnish additional protection.

# LOAD BUILDING

## New Street Lighting Builds Good Will

By N. GADA
General Electric Company, New Haven, Conn.

General commendation from the public, the press and city administration of Bridgeport, Conn., has resulted from the revision of the street-lighting system along the main and secondary thoroughfares in the business district of the city. To quote a local paper: "Now the driving public will never be satisfied until all the main thoroughfares in Bridgeport and many of the side streets are illuminated in the same manner."

In November, 1939, the United Illuminating Company submitted to the city a proposal for the modernization of street lighting in the business area, which was lighted by 379 magnetic arc luminaires on ornamental metal poles. The approved revision, which is now practically completed, consisted of replacing the 379 arc fixtures with 483 6,000-lumen incandescent fixtures.

Main thoroughfares have been equipped with 321 "Novalux Form 79-R" pendent units, mounted 22 ft. above the pavement on ornamental poles with 4-ft. brackets. These new units direct from 40 to 50 per cent of the total lamp light downward over the pavement area, as compared with from 15 to 18 per cent obtained with the older upright type luminaires. Average spacing of the units, staggered along the street, is about 100 ft.

Side streets in the business area have been equipped with 162 "Novalux Form 9" luminaires with 6,000-lumen lamps, mounted 14 ft. above the pavement on ornamental poles, and spaced, on an average, 150 ft. apart, staggered. This modernization program has also involved extensions of the "white way" system into several new territories, covering 21 blocks of city streets and a number of miscellaneous individual locations.

**MAIN STREET of Bridgeport, Conn., looks like this at night, after being relighted with pendent incandescent fixtures, mounted 22 ft. above the pavement, spaced 100 ft. apart, and equipped with 6,000-lumen lamps**

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## Are Room Coolers Worth Promoting?

By G. GILL FREYDER
Commonwealth Edison Company, Chicago

Electric room coolers are one of the notably "plus" load builders among the electrical appliances sold by this company. Most used during the summer, when the lighting load has fallen off, they consume approximately 700 kw.-hr. per connected horsepower per season, which is more than a domestic refrigerator. In fact, a typical ¾-hp. model uses twice as much electricity as a domestic refrigerator. And, while only one domestic refrigerator is used in the average home, several room coolers are desirable.

Nor is the market confined to homes; commercial and professional offices, hotel and hospital rooms back up the residential market. During 1939 roughly one-third of the 203 electric room cooler installations made by the company were in executive offices, one-third in physicians'

**YES, THIS PICTURE,** we admit, is a trifle far-fetched. But the fact is that customers who have installed *really* good lighting are continually amazed at the greater ease with which they can work and the better results they get.

Human beings, accustomed for ages to daylight outdoors, quickly sense improvements of lighting indoors and respond to them favorably in many ways. As indoor lighting approaches outdoor lighting, seeing becomes easier.

Today, although it is still impractical to provide daylight levels indoors, it is possible to

get as much as 50 footcandles or more . . . thanks to modern light sources and equipment. The more 50-footcandle installations that are sold, the closer we come to the goal of providing better light for better sight.

Fifty-footcandle installations are not hard to sell when you dramatize some of the fundamental Science of Seeing Facts for your customers. For example, how recently have you told your customers:

**THAT** *more than twice as much light is generally needed to read the stock market reports in a newspaper as is required to read front page news?**

**THAT** *handwriting in pencil usually requires nearly five times as much light to be as readable as the same handwriting in ink?*

*"We've been trying to get him to go home for weeks, but he won't believe it's night since we put in the new G-E Fluorescent Lighting!"*

**THAT** *merchandise displayed in good light sells faster than merchandise displayed in poor light because people can actually see it more quickly and decide faster?*

When you sell the man who runs a factory, store, or office, tell him that modern lighting is a powerful force that few people have even begun to use to full advantage. Show him how the additional expense of a 50-footcandle installation can be returned many times over in the form of reduced errors, increased sales or production, better, faster work with less fatigue, improved employee morale, and reduced accident hazards.

**HAVE YOU JOINED THE FORTY-NINERS' CLUB?**

The honor of membership in the Forty-Niners' Club is extended to any salesman who has been primarily responsible for selling an installation of 49-footcandles or more, or to any executive who works under 49 maintained footcandles. For full information, write to Secretary, Forty-Niners' Club, General Electric Company, Nela Park, Cleveland, Ohio . . . or consult your G-E Lamp Division for further details.

* See Chapter V, "The Science of Seeing" by M. LUCKIESH and FRANK MOSS.

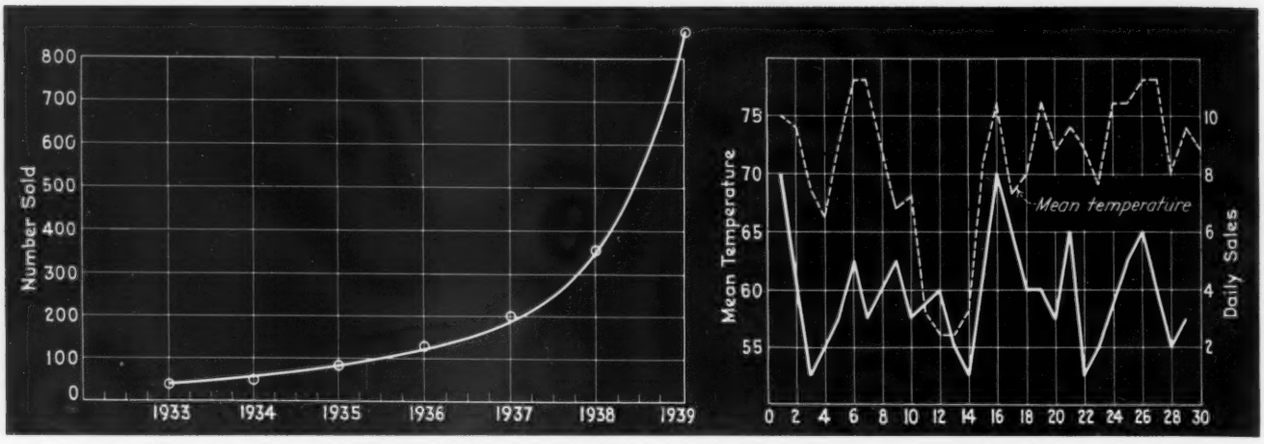
***FREE*** sample of "The Seeing Spinner!" A new gadget to help show how better lighting speeds seeing. Write to General Electric Co., Dept. 166-EO-D, Nela Park, Cleveland, Ohio.

**G-E MAZDA LAMPS**

**GENERAL ELECTRIC**

*Made to stay brighter longer*

**MAZDA . . . NOT THE NAME OF A THING, BUT THE MARK OF A RESEARCH SERVICE**




**ROOM COOLER SALES in Chicago for 1933 to 1939 (left) showed an upward sweep. Effect of temperature on sales during June, 1938 (right), shows room coolers to be a "straw hat" business**

and dentists' offices and one-third in homes. This dual field tends to give a balanced 24-hour load, with units in the offices operating during the day and those in the homes mostly at night.

Room cooler business is definitely of the "straw hat" variety. Weather sharply influences the sales volume. The accompanying chart shows how hot weather influenced the daily sales of room coolers by Commonwealth Edison Company during the month of June, 1939. Each hot day brought an increase in sales, followed by a decrease during the cooler weather.

It is the author's belief that room coolers must be merchandised. They are a specialty item and should be treated as such. Adequate and appropriate displays are necessary and model rooms, similar to those used in promoting electric kitchens, are desirable, since they give the customer an opportunity to visualize how an electric room cooler will look in the home or office, how it will blend with furniture and how its size compares with other room fittings. The fact that 33 per cent of the sales made by the Edison company last year were traceable to leads from the floor is proof of the value of a good floor display.

### *Trial Offer Effective*

This company has found the trial offer an effective means of breaking down sales resistance. Such a plan was used in 1939 with one make of window-sill model room cooler and was very successful. The installation expense is not much greater than that for a domestic refrigerator and the stimulation such a plan had on refrigeration sales in the early 1920's is well known by the industry.

The mass market for future sales of electric room coolers is obviously in the home. The increase in sales each year, shown on the accompanying chart, is largely the result of increased use in residences. Estimates of ultimate load value for electric room coolers in a city the size of Chicago are hazardous, but interesting. There are about 800,000 homes in Chicago. If, say, 25 per cent are potential buyers of a small window-sill model room cooler, and one is installed in each home, this represents a market for 200,000 small electric room coolers. If we further assume seasonal consumption to be only 250 kw.-hr. per room cooler it would mean a total additional use of 50,000,000 kw.-hr. per season. This, of course, does not include the room coolers installed in offices, hotels and hospitals, many of which are larger.

## Adapt Fluorescents to Irregular Space

Spacing of fluorescent units in the general offices of the Medical Protective Company, Medical Arts Building, Ft. Wayne, Ind., is necessarily variable because of the irregular arrangement space. Wakefield "Brigadier" units were placed one above each desk in the executive "pens" at left, while units over stenographers' desks in the foreground and above the aisle were arranged with their axes parallel to the windows. Units house four 40-watt white lamps each and are suspended 28 in. below a 10-ft. 6-in. ceiling to give from 20 to 40 foot-candles (after 250 hours) at desk tops. Thirty fixtures were installed on each of two floors of 4,346 sq.ft. for a density of 1.38 watts per sq.ft. Norman B. Hickox, lighting consultant, supervised the installation.

# PLUS 101%* MINUS 8.4%

***Kelvinator Refrigerator Sales to March 1st are up 101% over 1940. Selective Dealer Policy makes record sales possible with 8.4% fewer dealers***

*Just look at the record: Kelvinator Refrigerator Sales up 101 per cent compared with an industry increase of only 39 per cent! When Kelvinator first talked about "selective distribution" a year ago, it was not just an empty phrase. Kelvinator meant business . . . and the 101% sales increase with 8.4% fewer dealers is proof of the soundness of its Selective Dealer Policy.

These figures show what every refrigerator man knows—Kelvinator is definitely out in front. Dealer policy—product—prices—step-up sales program—everything is RIGHT!

*Get More—* **Get KELVINATOR**

# NEW EQUIPMENT

## Welding Rectifier

Self-contained ignitron rectifiers designed especially for supplying required d.c. current to magnetic energy-storage-type spot welders of the type used for joining aluminum in the aircraft industry are a recent announcement of this company. Each rectifier will operate two welders if they are sequenced so that only one can be loaded on the rectifier at a time, it is stated. Rectifier consists of control and protective panel, power transformer and ignitron tubes, all contained in a fan-forced ventilated, floor-mounted sheet metal cabinet with a welded base frame. Tubes are arranged for water cooling as controlled by a thermostatic water flow switch.

Ignitron rectifiers for magnetic energy-storage type spot welders; two capacities: One for use with 40-kw., the other for 120-kw. spot welders. **Westinghouse Elec. & Mfg. Co.,** East Pittsburgh, Pa.

•

## Laboratory Furnace

Thermocouple checking furnace; with heating elements for a.c. or d.c. operation on 115 or 230 volts; input ranges from 40 watts at 300 deg. F. to 1,000 watts at 1,800 deg. F., can be increased to 5,000 watts. **Leeds & Northrup Co.,** Philadelphia, Pa.

Small electric furnace provides zone of practically uniform temperature for intercomparison of laboratory standard thermocouples and for comparison of laboratory standard and plant standard couples. Drilled into cylindrical copper equalizing block inside the furnace are five wells to hold comparison standard and four couples being checked. With equalizing block, checks can be made within plus or minus 1 deg. F. from room temperature to 1,000 deg. F. Without it, checks can be made within plus or minus 3 deg. F. over a range of 300 to 1,800 deg. F.

•

## Bus Supports

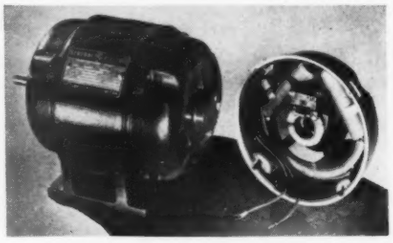
High-amp. capacity indoor bus support. **Delta-Star Electric Co.,** Chicago, Ill.

Bus support has conductor clamp for two channels or multiple bars, with a similar design without center spacing lugs for square-tube bus. Clamps with openings up to 12 in. square mounted on insulators of corresponding strengths are available.

•

## Capacitor Motor

Capacitor motors have been announced by this company as an extension to its recently announced polyphase induction motors. Capacitors are mounted inside the end shields of normal-torque motors and on top of those high-starting torque units of 1½ hp. and larger. Motors make use of a transfer switch—a centrifugal mechanism mounted on the rotor shaft, plus a stationary switch in the end shield—to transfer the motor from starting to running connection. As the motor approaches full speed, centrifugal force moves the collar of the rotating mechanism away from the switch, causing the switch to open.



"Tri-Clad" capacitor motor; end shield at right shows location of capacitors and transfer switch. **General Electric Co.,** Schenectady, N. Y.

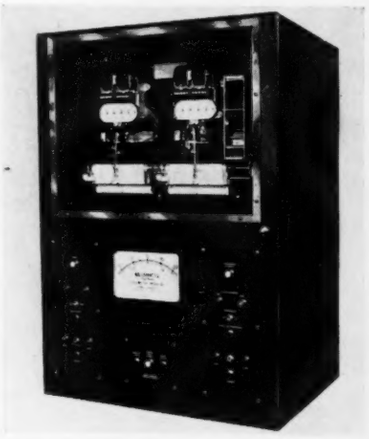
**Who Makes What?**

"Electrical Buyers Reference," published annually. **Electrical World,** 330 West 42d St., New York, N. Y.

Names, addresses and products of electrical manufacturers are catalogued in this convenient, annual publication for public utility, industrial, engineering and other major electrical buying interests.

## Telemetering

Continuous readings are afforded with this system of telemetering which makes use of a vacuum tube bridge system to keep the pointer of a 5-milliamp. d.c. movement in the same relative position as the pointer of the measuring or primary instrument. System requires but one pair of wires and will operate over a loop resistance of 2,000 ohms. It is applicable to any type of continuous indicating metering—watts, volts, amperes, water level or anything else that would be registered by any instrument having a pointer swinging through an arc. Auxiliary contactor unit can be furnished with telemeter receiver for setting up alarm circuit at any high and low meter values.



"TM-6" system of telemetering; unit shown is desk-type dispatcher's cabinet with megawatt receiver, center; cabinet also contains impulse-type telemeter equipment to show maximum demand and kw.-hr., associated supervisory control for automatically synchronizing 132-kv. oil circuit breaker located with telemeter transmitters at distant substation. **Control Corp.,** Minneapolis, Minn.

•

## Blower Fans

Type "FC" fan wheels, single and double widths, in sizes from 4½ in. wheel diameter to 60 in.; type "BI" fans range from 15 in. to 66 in.; capacities from 295 to 4,500 cfm. **The Trane Co.,** La Crosse, Wis.

Backward and forward curved blower fans for heating, cooling and ventilating applications are offered as separate products by this company. "FC" fans wheels are of the forward-curved, multi-blade type; "BI" wheels have twelve backwardly

"IT MAKES A DIFFERENCE TO ALL ETERNITY WHETHER WE DO RIGHT OR WRONG TODAY" *James Freeman Clark*

AND THAT IS WHY—

## UNIFORM HIGH QUALITY

RAW MATERIALS AND GALVANIZING ARE ASSOCIATED WITH *HUBBARD POLE LINE HARDWARE* AT ALL TIMES . . . WHETHER ORDERS ARE FOR FULL CARLOADS IN LUSH PERIODS, OR FOR ONE PIECE DURING THE SLACK SEASON.

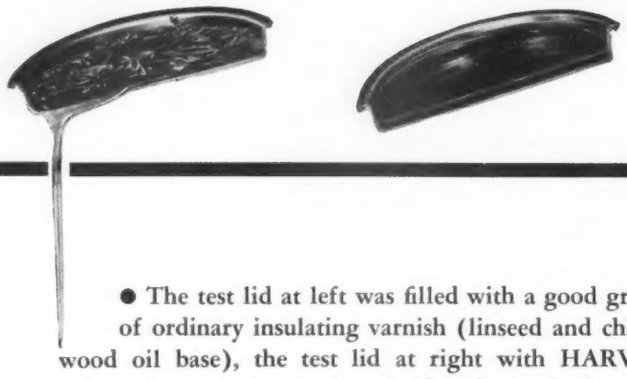
THAT *SPRING CONSTRUCTION* YOU ARE PLANNING WILL SERVE YOUR CUSTOMERS IN THE BEST POSSIBLE MANNER IF IT HAS THE UNIFORM DEPENDABILITY, STRENGTH AND DURABILITY THAT ARE SYNONYMOUS WITH THE NAME HUBBARD.

**HUBBARD AND COMPANY**

PITTSBURGH . . . OAKLAND . . . CALIFORNIA . . . CHICAGO

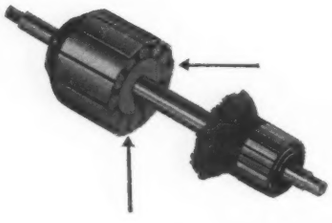
"HANG THE LOAD ON HUBBARD HARDWARE"

# TWO LIDS THAT TEACH A LESSON



● The test lid at left was filled with a good grade of ordinary insulating varnish (linseed and china-wood oil base), the test lid at right with HARVEL 612-C, the sensational phenol-aldehyde synthetic resin base insulating varnish made from Cashew Nut Shell Liquid. Both were baked for two weeks at 220°F. Then they were each cut in half—and look at what happened!

The Lesson: HARVEL 612-C, curing by polymerization, is not dependent upon "oxidation" but sets completely dry throughout irrespective of the thickness of its application. Ordinary varnishes, which dry mainly by "oxidation", set on the surface but usually leave the interior wet or tacky. Thus, HARVEL 612-C gives better protection, especially in deep windings as in the armature shown below, and can be applied far more rapidly in multiple coats by allowing merely a brief bake between dips and a single final bake of the completely treated winding.



HARVEL 612-C cannot soften or throw out and when cured, it is neither affected by acids, nor disintegrated by mild or concentrated alkali solutions. It is highly resistant to transformer and lubricating oil and maintains its insulating qualities at elevated temperatures far better than ordinary varnishes. It may be applied in any of the usual ways and because of its excellent dip-tank stability, there is no storage loss.

A new folder, outlining in detail the characteristics of HARVEL 612-C is yours for the asking. Write Dept. 46 for this folder or for consultation on your specific requirements.

**IRVINGTON VARNISH & INSULATOR CO.**

**IRVINGTON, NEW JERSEY, U. S. A.**

**PLANTS AT IRVINGTON, N. J. and HAMILTON, ONT., CAN.**

**Representatives in 20 Principal Cities**


inclined blades. Direct-connected units are included in the line and consist of integral motor brackets, fan housing and single-width wheel mounted directly on motor shaft.

•

## Limit Switch

Roller arm on this limit switch is adjustable through an arc of 225 deg. around its pivot pin and also has a horizontal adjustment in eight positions 45 deg. apart. Suitable for slide or cam actuation, the switch operates on two to four degrees movement with provision for 20 to 30 deg. overtravel of the arm.

"Roller Arm Metal-Clad Micro Switch;" 1,200 watts up to 600 volts a.c.: single-pole, with normally closed, normally open or double-throw contact arrangements. **Micro Switch Corp.**, Freeport, Ill.

•

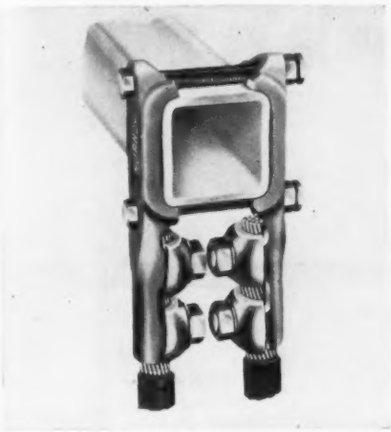
## Cable Clamps

Completing its line of suspension and strain clamps for hollow copper cables, this company announces suitable designs for any type, size or make of cable. These clamps are said to meet recommendations and requirements of copper cable manufacturers. Strain clamps for hollow copper cable includes principal features of company's "Hi-Lite" standard clamps. Clamp bodies are made of processed malleable iron, with steel nuts, bolts and rivets, all hot-dip galvanized. Copper liners are furnished with all clamps.

Typical suspension clamp for hollow copper cable. **Ohio Brass Co.**, Mansfield, Ohio.

## Cable Taps

Connectors for square tubular bus are announced by this company. Connector is designed to concentrate pressure on



Type "N2QTT" double cable tap joining two 500,000 circ.mil cables to a 3-in. square tube; other types available for all sizes of square tube and for various conductor combinations. **Burndy Engineering Co., Inc.,** 459 East 133d St., New York, N. Y.

rounded corners of square tube, to provide high contact pressure with low contact resistance. Clamping elements are situated to provide minimum of bulk and projection.

•

## Instrument Charts

Microfilm system for recording instrument charts. **Permochart Co.,** Sewickley, Pa.

For applications where it is necessary or desirable to save chart records, this company has established a microfilm photographic system for recording and filing. According to the manufacturer, this method reduces filing space by 98 per cent of that normally used.

•

## Time Switch

As a control for protective lighting installations, this company suggests its motor-operated oil-break switches with self-winding astronomic dials, which have been designed to withstand heavy overloads. Switch unit is of the mechanically locked type and is an integral unit with the tim-

Type "ZMO" self-winding time switch with astronomic dial; obtainable from stock for 100, 200 and 300 amp., double- and triple-pole; 110 or 220 volts. **The R. W. Cramer Co., Inc.,** Centerbrook, Conn.

ing element. Astronomic dial makes switch automatic for turning lights on at dusk and off at dawn.

•

## TECHNICAL LITERATURE

WATER CONDITIONING—Designed as a basis for selecting proper method of feed water conditioning, new 48-page catalog on hot-process water softeners has been published by Cochrane Corp., Philadelphia, Pa. Book includes a nine-page appendix on feed-water chemistry, in addition to heat balances, flow diagrams, construction drawings and engineering tables and charts. Treatments for all water conditions are discussed. Copy of this publication 3000 may be obtained from the company.

CABLE OPERATION—Publication No. H5, "Cable Operation 1939", contains a report of the Transmission and Distribution Committee. Edison Electric Institute, covering the operation of 16,400 miles of cable, 336,000 joints and 47,900 potheads. Copies are available from E.E.I., 420 Lexington Ave., New York, N. Y., priced at $1.50 each to non-members in the U.S.A.

TRUCK SPECIFICATIONS — Specifications and Body Builder's Layouts for two utility construction and maintenance trucks have been published by The Four Wheel Drive Auto Co., Clintonville, Wis. Trucks thus treated are the Models "SU-CP" and the "HST".

TRANSFORMERS—New 8-page illustrated bulletin telling how to apply CSP power transformers—completely self protecting, self-contained substations for single feeder service—is announced by the Westinghouse Elec. & Mfg. Co. Copies of this application data 211 may be obtained from Dept. 8-N-48 of Westinghouse at East Pittsburgh, Pa.

DRYING LAMPS—How to apply radiant heat lamps to industrial drying, baking and heating tasks is told in a new 12-page illustrated booklet A-3817 published by the advertising department of the Westinghouse Lamp Div., Bloomfield, N. J. Application data, with formulas for calculating the number of kilowatts required to produce the necessary amount of heat, and recommended spacing of the lamps are included.

PYROMETER CHECKING—A 28-page catalog issued by Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa., lists apparatus needed for plant or laboratory checking of thermocouple pyrometers. Recommendations are also included.

WIRING CALCULATOR—Pocket-size wire calculator, called the "Wirometer" for use in computing wiring problems in accordance with the 1940 National Electrical Code, has been developed by the General Electric appliance and merchandise department, Bridgeport, Conn. Device uses six interchangeable cardboard slides to cover the various building wires. It includes information on voltage drops for eight distribution systems.

OHM'S LAW CALCULATOR — Answers to Ohm's law problems may be obtained with one setting of the slide on this calculator which covers current and wattage ranges to 100 amp. and 1,000 watts. Copies are available on request on company letterhead to Ohmite Mfg. Co., 4835 Flournoy St., Chicago, Ill., plus 10 cents for postage.

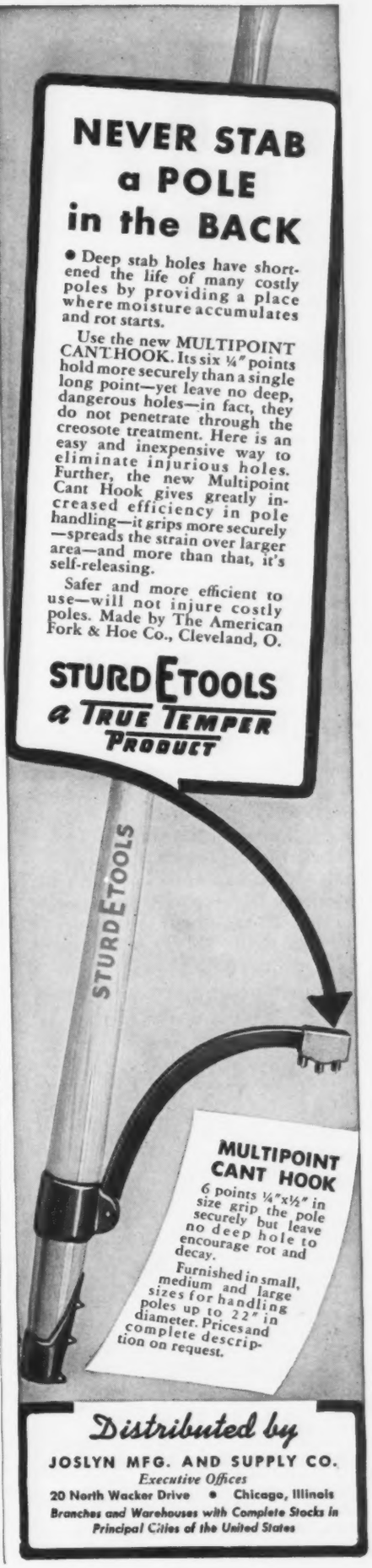

NEVER STAB a POLE in the BACK

• Deep stab holes have shortened the life of many costly poles by providing a place where moisture accumulates and rot starts.

Use the new MULTIPOINT CANT HOOK. Its six ¼" points hold more securely than a single long point—yet leave no deep, dangerous holes—in fact, they do not penetrate through the creosote treatment. Here is an easy and inexpensive way to eliminate injurious holes. Further, the new Multipoint Cant Hook gives greatly increased efficiency in pole handling—it grips more securely—spreads the strain over larger area—and more than that, it's self-releasing.

Safer and more efficient to use—will not injure costly poles. Made by The American Fork & Hoe Co., Cleveland, O.

STURDETOOLS
a TRUE TEMPER PRODUCT


STURDETOOLS
MULTIPOINT CANT HOOK
6 points ¼"x½" in size grip the pole securely but leave no deep hole to encourage rot and decay.
Furnished in small, medium and large sizes for handling poles up to 22" in diameter. Prices and complete description on request.

Distributed by
JOSLYN MFG. AND SUPPLY CO.
*Executive Offices*
20 North Wacker Drive • Chicago, Illinois
*Branches and Warehouses with Complete Stocks in Principal Cities of the United States*

# NEWS ABOUT PEOPLE

## W. E. Wood Named Head of Virginia Public Service

William E. Wood, vice-president of Stone & Webster Service Corp., New York, has resigned from that position to become president of the Virginia Public Service Co. Mr. Wood was elected head of the Virginia utility at the annual stockholders' meeting held at Charlottesville, Va., on April 1. He is to replace M. J. O'Connell, who announced his resignation early in January to become effective April 1. The selection of Mr. Wood followed consultations by the State Corporation Commission of Virginia, the company's board of directors and Denis J. Driscoll and Willard L. Thorp, trustees of Associated Gas & Electric Corp.

Mr. Wood has had extensive utility experience in executive capacities over a period of 34 years and is familiar with the territory served by the Virginia

*Blank & Stoller*

Public Service Co. through his former connection with the Virginia Electric & Power Co., Richmond, of which he was vice-president and later president.

A native of Aiken, S. C., and a graduate of Georgia Tech, he acquired experience in management affairs at Jacksonville, Fla., before he became connected with the El Paso Electric Co. of Texas, of which he was superintendent from 1916 to 1918. In 1918 he was made manager of the Houston Electric Co. of Texas, which position he held until 1925, when he became vice-president of Virginia Electric & Power Co. He served in this capacity until 1927, when he was elected president. In 1929 he resigned to become connected with Stone & Webster with headquarters in New York.

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▶ HARRY M. MILLER, Gallipolis, Ohio, executive secretary to Gov. John W. Bricker, has become a member of the Ohio Public Utilities Commission, succeeding Judge Roy D. Williams, Athens, whose term expired last January.

▶ AARON E. KLINGENSMITH, chief engineer of the C. C. Perry plant of the Indianapolis Power & Light Co., has retired from active service after 22 years association with the company. He has been succeeded by L. C. Stang, who before becoming connected with the company was a construction engineer on the new 50,000-kw. unit of the Dresser station.

▶ H. M. GANSMAN, a vice-president of the Westinghouse Electric Supply Co. in New York City, has transferred his headquarters to Philadelphia and has taken over management of the company's middle Atlantic district there. Management of the company's expanding radio receiver business has also been transferred to Philadelphia under Mr. Gansman.

▶ ALFRED J. BOHL has been elected secretary and treasurer of the Wisconsin Electric Power Co. LESTER M. LAPORTE has been made comptroller and JOHN HEISS assistant secretary and assistant treasurer. Two new directors were elected to the board: HAROLD S. FALK, president of the Falk Corp., Milwaukee, and LAWRENCE F. SEYBOLD, vice-president of Wisconsin Electric Power Co.

## Atlantic City Electric Promotes R. E. Swift

Richard E. Swift recently assumed the duties of vice-president and general manager of the Atlantic City Electric Co., Atlantic City, N. J., succeeding

E. A. Lewis, who has become vice-president and general manager of the Indiana and Michigan Electric Co., another subsidiary of the American Gas & Electric Co.

Mr. Swift was born in Virginia and received his education at the Virginia Military Institute. He joined the sales force of the Scranton Electric Co. in 1911 and in 1914 he entered the sales department of the Atlantic City Electric Co. Three years later he was promoted to the position of commercial manager, a position he held until his promotion in 1935 to assistant general manager of the company.

•

▶ HOWARD M. GORE of Clarksburg, formerly Governor of West Virginia, was recently appointed a member of the West Virginia Public Service Commission by Governor Neely. He succeeds Alex Mahood, who resigned last month. Mr. Gore was Governor of West

When you "modernize" your underground distribution with Orangeburg Conduits, you modernize for today—and tomorrow.

Being essentially pitch, Orangeburg is essentially everlasting—provides permanent raceway facilities for the needs of twenty, thirty or more years in the future.

Furthermore, the complete cable protection provided by Orangeburg during these years of service should interest those looking for low-cost cable maintenance. Orangeburg means protection against electrolysis and chemical corrosion.

Add to this Orangeburg's low installation cost and you have the reason why you, too, should investigate all of the advantages of this widely used conduit.

*Sales Agent—Distributors*

General Electric Supply Corp.

Graybar Electric Company Inc.

*Build for tomorrow with*

# ORANGEBURG *Conduits*

MADE AT ORANGEBURG, NEW YORK BY THE FIBRE CONDUIT COMPANY, 292 MADISON AVE., NEW YORK CITY

ORANGEBURG NOCRETE for installation without concrete encasement
STANDARD for installation with concrete encasement

Here's how this job is done. Bars, after cleaning, are quickly and accurately positioned in a simple jig. Inserts of SIL-FOS, cut to size from a roll of .010" thick strip, are placed between bars at the joints and clamped in place. Heating by oxy-acetylene torch until SIL-FOS flows freely finishes the job. The speed, reliability and economy of this metal joining method is due to the low flow point of SIL-FOS (1300 Deg. F.) and the rapid penetration this alloy gives.

# Change to SIL-FOS brazing of Bus Bars – cuts costs 50%

The switchboard bus system illustrated provides a fine example of the substantial economies Sil-Fos brazing makes possible on electrical work. This system is made up of 1/4" x 1 1/2" cold drawn copper.

Formerly, parts were assembled by riveting and sweating with soft solder, followed by hand cleaning. Now, they braze with Sil-Fos, acid dip and neutralize, with savings in costs close to 50%.

But economy is not the only benefit Sil-Fos brazing provides. Joints are stronger and more efficient electrically. Their electrical conductivity is higher and the surfaces joined cannot oxidize. In fact, a Sil-Fos brazed bus system is, in effect, **jointless;** and hence permanently free from joint troubles and joint maintenance.

## FIND OUT WHAT SIL-FOS BRAZING WILL DO FOR YOU

If bus bar construction—or any other non-ferrous metal joining—is part of your work, you can't afford to overlook the joint-improving, time and cost saving possibilities of Sil-Fos brazing. We'll be glad to demonstrate in your plant. Write today for full details and Bulletin EW-5.

**HANDY & HARMAN** 82 FULTON ST., NEW YORK

*Agents in Principal Cities.* In Canada: HANDY & HARMAN of Canada, Ltd., Toronto


Virginia from 1925 to 1929. No one has as yet been appointed by Governor Neely to succeed Chairman John J. D. Preston on the commission.

## Canadian G. E. Elects Two Vice-Presidents

The appointment of H. M. Turner and J. C. Macfarlane, K.C., as vice-presidents of Canadian General Electric

H. M. Turner

J. C. Macfarlane

Co., Ltd., has been announced by D. C. Durland, president.

Mr. Turner has held the office of comptroller and Mr. Macfarlane has been in charge of the company's law and patent department.

•

► CHARLES COOK has been appointed manager of steam service at the South Philadelphia works of the Westinghouse Electric & Manufacturing Co. Mr. Cook has been with the company since he joined the marine service department in 1918. Since 1920 he has been in charge of the engineering ac-

# Fiberglas* Insulation cut losses from downtime on the toughest jobs

LAST YEAR a certain Midwestern steel plant changed over to Fiberglas for electrical insulation.

Result: $24,000 saved on maintenance (according to the company's own figures).

In addition, *they had less downtime* on equipment that worked in moisture...

. . . in scorching heat, dust, flying scale-particles from the rolling mills . . . over pickling baths where corrosive acid fumes surround the motors . . . and on cranes where many stops and starts cause serious overloads.

What's more, the company made that $24,000 saving even though they had *more* equipment running *more* hours than the previous year!

*Wherever* you have tough jobs to do, Fiberglas may well do them better, with fewer headaches, and at less cost.

Perhaps you don't have motors working under tough conditions. Perhaps the surroundings in which your motors work are entirely normal.

### *Then so what?*

Is it possible for Fiberglas-insulated motors to help you?

Yes! *And in a very important way!*

Today, industry is gearing up for defense production. 24-hour schedules are becoming more and more common. And as machinery operates more hours per day and at greater speeds, *the hazard of downtime mounts.*

You need an additional safety factor in your motors. And you can get the maximum safety factor in standard-size Fiberglas-insulated motors.

Also, today important motor manufacturers are making smaller-size Fiberglas-insulated motors which operate safely at approved higher temperatures.

### *And the pay-off?*

Even these smaller motors have a substantially larger safety factor than ordinary motors insulated with class A materials. And their cost is little, if any, more.

So, with the expensive bugaboo of downtime looming larger on the industrial horizon, watch out! In new equipment or in your next repair job, specify complete Fiberglas Electrical Insulation. *Owens-Corning Fiberglas Corporation, Toledo, O. In Canada: Fiberglas Canada, Ltd., Oshawa, Ont.*

**OWENS-CORNING**

**FIBERGLAS***

*T. M. Reg. U. S. Pat. Off.

**TO ELECTRICAL ENGINEERS:** Besides being a superior insulation for motors and generators, as the above case history shows, we believe you will find Fiberglas has definite advantages for all types of electrical equipment. This insulation comes in all standard forms. Write us for further technical data.

# HOW ON EARTH DID THEY DO IT?

**Speed of Aircraft Faster Than Radio**

Radio has to move fast to keep up with the aircraft industry. United Aircraft Corporation, invited to participate in a nation-wide broadcast to describe the industry's part in national defense, Saturday afternoon agreed, as part of the program, to have a broadcast from its gear-grinding department. Microphones were set up in the department Friday afternoon.

Saturday morning radio engineers went 'round again for a check-up. They found the 150 or more gear-grinding machines had been moved during the night to another part of the 37½-acres plant, leaving the microphones standing as lone sentinals. The grinders averaged about one half ton weight. They were moved to new locations at a speed that averaged one every 53 seconds. Altogether it was about a 2-hours job.

The microphones had to move quickly to catch up.

REPRODUCED FROM THE HARTFORD COURANT

*with* **FLEX-A-POWER** *of course*

TRUMBULL

They had FLEX-A-POWER installations in both old and new buildings. All they had to do was "pull" out the individual FLEX-A-PLUGS connecting to the machines, move the machinery to new locations and "plug" them in on the new FLEX-A-POWER lines. That's the outstanding feature of this modern bus bar system for making direct electrical connections to machines.

And it's a mighty important feature to have in YOUR plant these days . . . especially when you consider that a Trumbull FLEX-A-POWER installation frequently costs LESS than old power wiring methods and is COMPLETELY SALVABLE.

*Write at once for* FLEX-A-POWER TRUMBULLAID Bulletin No. 408

ESTABLISHED 1899

THE TRUMBULL ELEC. MFG. CO.

PLAINVILLE CONN. U.S.A.

A GENERAL ELECTRIC ORGANIZATION

KEEP *Alert* ELECTRICALLY use your TRUMBULLAIDS

NEW YORK - PHILADELPHIA - BOSTON - CHICAGO - DETROIT - LUDLOW, KY. - ATLANTA - NASHVILLE - LOS ANGELES - SAN FRANCISCO - SEATTLE


tivities of the service department at the South Philadelphia headquarters of the company.

▶ PAUL HELMS has been appointed purchasing agent of the Roller-Smith Co., Bethlehem, Pa., to succeed HARRY A. CASSLER, resigned. Mr. Helms joined the Roller-Smith organization in 1926, and has been assistant purchasing agent since 1939. Mr. Cassler had served as purchasing agent for the past 20 years. He has long been associated with the Lehigh Valley Purchasing Agents Association and is a past-president of this organization.

▶ ELLIOTT HARRINGTON has been named sales manager of the General Electric air conditioning and commercial refrigeration department, with headquarters at Bloomfield, N. J. Mr. Harrington has been connected with General Electric air conditioning and automatic heating activities from their inception, and his early assignments on the development of an automatic oil furnace led directly to the formation of the department, in which he has served in various engineering and sales capacities. Under the new arrangement he will supervise distribution and policy matters, and under him will operate three separate sales sections. The automatic heating sales section is under the direction of L. H. HOBSON; the cooling equipment sales section is headed by C. M. ROWLAND and the contractor and industrial sales section by S. MARTIN, JR. FRANK H. FAUST has been appointed commercial engineer of the entire department and E. B. MCCLELLAND assistant sales manager. In the absence of the manager, J. E. KUSIK will be in charge of the air conditioning and commercial refrigeration department.

## OBITUARY

▶ RINALDO E. MARTIN, superintendent of power stations of the West Penn Power Co., died suddenly, March 24, while attending a meeting of the West Penn Savings and Loan Association in Springdale, Pa. Mr. Martin was born at Hendersonville, Pa., on October 7, 1893, and entered the service of Wheeling Traction Co. in 1914. He was assigned to the Wheeling, Washington and Connellsville power stations of the West Penn Power Co. and in 1920 he was sent to Springdale as combustion engineer at the power station. Moving along rapidly at Springdale, in 1921 he became chief engineer, in 1924 boiler room superintendent, four years later superintendent in complete charge of activities at the power station and in 1930 he was made superintendent of power stations covering the entire system. Mr. Martin was a member of

# for "DIELECTRIC ABSORPTION"
## the New Technique in Testing Electrical Insulation

"MEGGER"
TRADE MARK REGISTERED U.S. PAT. OFF.

**Insulation Tester** 2500 Volts—10,000 Megohms—Motor-Driven

**This general-purpose "Megger" Insulation Tester is available with one, two or three voltage ratings in the same set, e. g., 625, 1250 and 2500 volts d. c. The motor is operated from a lighting circuit.**

In Bulletin 1660-W, just issued, we discuss the very important characteristic of insulation, known as *Dielectric Absorption,* and how measurements of it are being made with our Motor-Driven "Megger" Sets.

By means of these *non-destructive* insulation resistance-time tests (especially when made at two or more testing voltages), much is being learned about the condition of insulation in large generators and other electrical equipment. This new procedure undoubtedly represents a mile-stone in the art of insulation testing.

Your copy of Bulletin 1660-W, which includes also a description of our Motor-Driven "Megger" Sets, will be sent promptly upon request.

**Getting Results with Hand-Driven "Megger" Testers**

*For those who do not have large generators or long cables to maintain, but who desire to get the most out of their "Megger" instruments in testing other types of equipment, we have written Bulletin 1655-W having the above title. Write for a copy.*

**JAMES G. BIDDLE CO.**

1211-13 ARCH STREET *Electrical and Scientific Instruments* PHILADELPHIA, PA.

# HERE'S HOW TO PROTECT HIGH-VOLTAGE EQUIPMENT ON UPPER FLOORS!

***Use J-M Trancell—a lightweight, strong, fireproof housing material that won't overload balconies***

POWER STATIONS throughout the country are finding in Trancell the answer to the problem of protecting high-voltage equipment on balconies and upper floors. And, in addition to its light weight, this tough asbestos product offers these advantages:

**Compared with concrete,** Trancell is much easier to install, for it comes in large, light sheets . . . is quickly installed with ordinary tools. Construction is entirely dry.

**Compared with metal,** Trancell is much easier to maintain. An asbestos product, it can't rust, never requires shutdowns for cleaning or painting. Condensation troubles are minimized. And not only is Trancell completely fireproof, its low thermal and electrical conductivity prevents damage to adjacent equipment.

Full details will show you how you can add new safety and economy to your station with J-M Trancell. Write for brochure DS-426. Johns-Manville, 22 East 40th Street, New York, N. Y.

JM

**Johns-Manville TRANCELL**

***AN ASBESTOS PRODUCT***

***for better cell structures and doors***


the prime movers committee of the Pennsylvania Electric Association and of the American Society of Mechanical Engineers.

▶ ODELL HAUSER, executive assistant in the public relations department of the Philadelphia Electric Co., died on February 10 at the University Hospital, after a long illness. He was 54 years old. A native of New York and a graduate of Columbia University, Mr. Hauser had extensive experience in the newspaper field and in public relations work before affiliating himself with the Philadelphia Electric Co. in 1937.

EDWARD D. HOCKING, superintendent of the electrical construction bureau of the Consolidated Edison Co. of New York, died on December 31, after a long illness. He had completed 36 years of service and was 52 years old.

▶ JOSEPH B. EDWARDS, retired president of the Kellogg Switchboard & Supply Co., died February 20, of a heart attack, in his apartment in Evanston, Ill., in his eightieth year. At one time he was head of the Western Electric Co. works in Antwerp, Belgium. Later he joined the Kellogg company and directed it for many years.

▶ WILLIAM H. VICKERS, personnel director for the Consolidated Gas, Electric Light & Power Co. of Baltimore, died on March 3 at his home in Baltimore, in his fifty-seventh year. Mr. Vickers had been connected with the Baltimore utility for 24 years.

▶ ALBERT W. MOULDER, 52, vice-president of the General Fire Extinguisher Co. and of the Grinnell Co., Inc., Providence, R. I., died February 11 in that city, after a short illness. He had been associated with the above organizations for 30 years, formerly at Warren, Ohio, and for the past eleven years in Rhode Island.

▶ HARRY C. ROSS, personnel manager of the Pacific Gas & Electric Co., died in a hospital in San Francisco on February 21, after a week's illness. He was 55 years of age. Mr. Ross had been connected with the utility for 35 years. His first job was at Fresno, where he was manager of that district for a number of years before being transferred to San Francisco in 1930. Later he was appointed manager of the claims and safety division and four months ago he assumed the duties of personnel manager.

▶ ROWLAND J. HASTINGS, 60, a prominent member of the Massachusetts bar, who had served as counsel for the New England Power Association, died February 18. He was a resident of Worcester.

# *Bridgeport's* INSTALLATION *of* HOLOPHANE REFRACTORS *has received both technical and popular*

**. . . . . Best results are always assured with Recommended Practice and Holophane Refractors**

Modern street lighting practice recommends that: "In any arrangement selected, a dominating consideration is the light distribution characteristics of the luminaire used" . . .

The units that meet these requirements with the maximum degree of efficiency are Holophane Refractors . . . With these refractors the light is "shaped" to the street with horizontal distributions providing a higher degree of *useful* illumination. The vertical distributions permit wider spacings and hence substantial economies . . . Added to these savings are other economies derived from control of light (no wastage) lower maintenance costs and reduced deterioration.

Follow Recommended Practice and sound judgment by specifying Holophane Refractors. Your equipment manufacturer will give you the data; or write direct to Holophane Street Lighting Division, Newark, Ohio.

*SEND FOR NEW BULLETIN: "Recommended Practice of Street Lighting"*

**Holophane**

COMPANY, INC. — Lighting Authorities—Since 1898

342 MADISON AVE. NEW YORK CITY

THE HOLOPHANE CO. LTD. 345 Yonge St., Toronto, Canada

# MANUFACTURING - MARKETS

## Manufacturers Issue Reports for 1940

Net income of Canadian General Electric Co., Ltd., for 1940 was $2,308,019, as against $2,150,027 in the previous year. Income from operations, profit from sale of securities and other income totaled $6,332,566. The balance to earned surplus was $700,384 after dividends, expenses, taxes, etc.

Among the other electrical manufacturing companies recently reporting 1940 operations are the following:

WESTON ELECTRICAL INSTRUMENT—Including subsidiary, net profit, after $25,000 provision for contingencies and $370,000 for excess profits taxes, was $734,842, equal to $4.57 each on 160,583 shares of capital stock, excluding 3,417 shares held in treasury. This compares with 1939 net of $527,201, or $3.03 a share on 160,583 shares of common stock, after dividends on Class A stock then outstanding. Net sales last year increased to $6,089,467 from 1939 volume of $4,349,425.

HYGRADE SYLVANIA—Net earnings, $880,625, after deducting all charges and taxes, compared with $856,807 for 1939. Last year's earnings equal $3.59 a share on 207,184 shares of common stock outstanding on December 31, 1940 after payment of preferred dividends of $6.50 a share on the old preferred stock. Gross sales, less returns and allowances, rose to $14,358,809 in 1940 from $11,022,424 in 1939. This 30 per cent increase is accounted for mainly by the increased sale of the new fluorescent lamps and miralume lighting fixtures. Total taxes paid to Federal, State and local governments reached a total of $755,532 which exceeded the 1939 tax total by $161,000.

ACME WIRE—Including subsidiaries, net profit, $243,201, equal to $2.11 a share on 115,500 shares of common stock, compared with $182,417, or $1.58 a share in 1939.

WESTERN ELECTRIC—Net income after all expenses and charges, $32,787,030, equal to $5.46 a capital share, and comparing with a net of $16,476,086, or $2.75 a share, in 1939. Volume of business in 1940 was the largest in ten years. Sales aggregated $241,618,000, an increase of 29.3 per cent over 1939.

CURTIS LIGHTING—Including Canadian subsidiary, net income $88,135, after depreciation, interest, federal income taxes, etc., equal to 52 cents a share on 170,160 shares of common stock. This compares with net income of $58,167, or 34 cents a share in 1939. Current assets as of December 31, 1940, amounted to $617,321 and current liabilities were $136,525, against $474,223 and $77,048, respectively, at the end of 1939.

WORTHINGTON PUMP & MACHINERY—Including domestic subsidiaries, net income, $2,236,158, compared with $816,706 in 1939.

•

## Starts New Construction

Work has begun on construction of a $500,000 addition to the Sterling Engine Co. plant in Buffalo, President Addison F. Vars has announced. The new building will be ready by September and will be used for assembling and testing engines.

•

## Reports Employment Rise

Kellogg Switchboard & Supply Co., Chicago, has announced an increase of about 20 per cent in the number of employees during the past year.

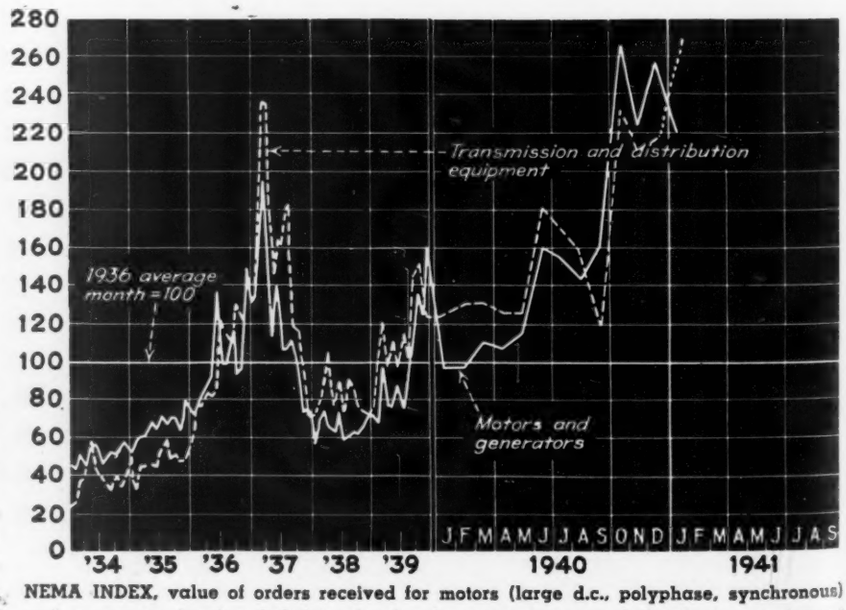
## January Equipment Index Hits New High

Orders received for transmission and distribution equipment reached a new high for January, according to indices of the National Electrical Manufacturers Association. The index advanced 29.2 points to 269 from the December index of 219.8, a rise of 22.4 per cent.

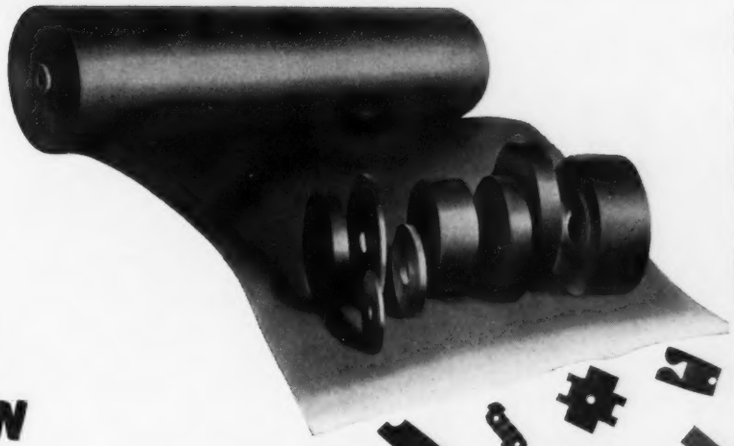
Orders received for motors and generators declined somewhat from the December high, but made a new high for the month.

The index of value of orders received for January declined 41.4 points to 220.6 from the revised December index of 262, a drop of 15.8 per cent. In January, 1940, the decline from December was 39.8 per cent.

N.E.M.A. also reported that the index of sales billed for January rose 22.6 points to 187.4 from the December index of 164.8, an increase of 13.7 per cent. A year ago the advance was 2.4 per cent from December.




**NEMA INDEX, value of orders received for motors (large d.c., polyphase, synchronous) and generators (engine, belt-driven); also for transmission and distribution equipment**



A
THIN
TOUGH–PLIABLE
*Vulcanized Fibre*
Electrical
Insulation

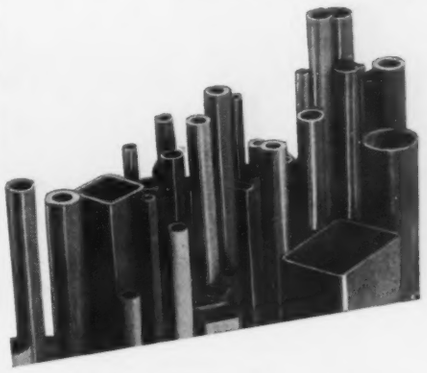
# DIAMOND INSULATION

## Now available in a new moisture resistant grade

Desirable hardness is combined with the inherent essential toughness and flexibility of DIAMOND INSULATION in this superior quality fish paper. Now moisture resistance, almost equal to that found in phenol fibre, has been incorporated in WR DIAMOND INSULATION —a new grade already being widely used where thin, tough, pliable insulation is needed.

Both grades of DIAMOND INSULATION, Regular and Grade WR, are ideally adapted to high speed fabrication of small parts, special shapes, and formed liners. Continuous rolls—any width up to 48" are available in thicknesses of .004" to and including 1/32". From 1/32" to 1/8" they are made in standard sheets approximately 48" x 80".

***Adaptable Forms of Phenol Fibre***



### *DILECTO TUBING*

Replacing scarce metals . . . speeding up assembly and production operations . . . improving product performance . . . cutting costs . . . DILECTO phenol fibre tubing can serve you well.

- ✦ **extremely high dielectric properties.**
- ✦ **great mechanical strength.**
- ✦ **light in weight (about half the weight of Aluminum)**
- ✦ **practically unaffected by moisture.**
- ✦ **highly resistant to chemicals.**
- ✦ **CAN BE readily cut, sawed, punched, machined, drilled, threaded, reamed, polished, engraved.**

**STANDARD Grades and Sizes**

There are eight standard grades of Dilecto tubing with properties ranging from—

- V **90 to 500 volts per mil DIELECTRIC STRENGTH**
- V **5,000 to 9,000 pounds per square inch. TENSILE STRENGTH**
- V **10,000 to 19,000 lbs. per sq. in. COMPRESSIVE STRENGTH**
- V **Specific gravity — approximately 1.471.**

All grades are available in a variety of standard sizes, thus expediting delivery, simplifying design and speeding up production. For complete technical data and specifications, ask for catalog DO-12.

***Send TODAY for this book!***
Complete Data on all C-D non-metallic products. Ask for GF 12

**Continental-Diamond FIBRE COMPANY**
*"Manufacturers of Laminated Plastics Since 1911"* — NEWARK • DELAWARE

# AND THEN—

*there must be light and power!*

YES, when a new defense plant is completed —kilowatts must be instantly on tap!

And that calls for the best efforts and close cooperation of electric light and power company, consulting engineer, contractor, wholesaler, and electrical product manufacturers.

Although faced with the urgent and ever-increasing demands of not only the Government but of every branch of industry, as well—Roebling is striving to the very limit of its resources to meet this emergency.

Roebling plants are operating day and night—at full capacity—to satisfy the unending need for high quality electrical wires and cables.

ROEBLING 1841 1941 100th ANNIVERSARY

# ROEBLING
## ELECTRICAL WIRES AND CABLES

JOHN A. ROEBLING'S SONS COMPANY TRENTON NEW JERSEY

Branches in Principal Cities Export Division: 19 Rector St., New York, N.Y., U.S.A. Cable Address: "Roebling's", New York


## Refrigerator Sales High in February

Domestic sales of household electric refrigerators to distributors and dealers during the month of February by twelve companies totaled 333,335 units, according to the report issued by the National Electrical Manufacturers Association. This compares with 261,328 units sold by sixteen companies in February, 1940, and 349,901 units by twelve companies in January, 1941. This put sales in the domestic market up to 683,236 units for the first two months of this year, compared with 479,578 units for the similar period of 1940.

Canadian sales dropped from 5,275 units in February, 1940, to 4,255 units in February this year. Other world sales, however, increased and total world sales during the month amounted to 347,337 units, compared with 275,366 units for February, 1940. In the first two months of the year world sales amounted to 710,895 units, compared with 503,188 a year ago.

Electric range sales also advanced sharply. Eighteen companies sold 51,790 units in February compared with 32,998 units by nineteen companies in February last year. In the first two months of the year sales numbered 102,306 units, compared with 69,393 for the similar period last year.

•

## Westinghouse Contract

The Navy Department has entered into a contract with Westinghouse Electric & Manufacturing Co. for the constructing, equipping and organizing for operation of a plant for the manufacture and assembly of ordnance equipment at an estimated cost not to exceed $16,150,000 on a site acquired by the Navy near Canton, Ohio. The contract requires that the work be done at actual cost plus a fixed fee to the contractor of $425,000.

•

## Reynolds Metals Contract

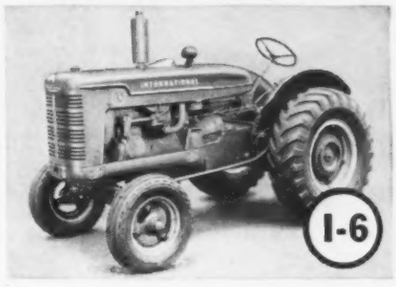
Reynolds Metals Co. has signed a new 20-year contract for 20,000 kw. of Bonneville-Grand Coulee power, bringing its total to 60,000 kw.

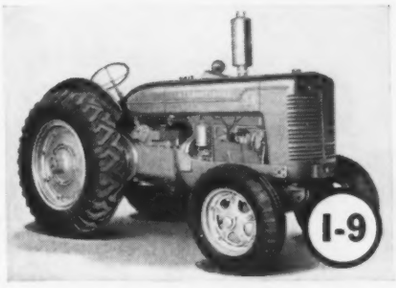
### New York Metal Prices

| | April 1, '41 Cents per Pound | Mar. 26, '41 Cents per Pound |
|---|---|---|
| Copper, electrolytic | 12.00* | 12.00* |
| Lead, A. S. & R. Price | 5.85 | 5.75 |
| Antimony | 14.00 | 14.00 |
| Nickel, Ingot | 35.00 | 35.00 |
| Zinc Spots | 7.64 | 7.64 |
| Tin, Straits | 52.125 | 52.50 |
| Aluminum, 99 per cent | 17.00 | 17.00 |

* Delivery Connecticut Valley.

# 5 NEW INTERNATIONAL Industrial WHEEL Tractors



• Here are International Harvester's latest products for the men who use industrial power—five *brand-new* International Industrial WHEEL Tractors. These "I" Tractors, added to the line of International TracTracTors and Power Units announced in 1940, make *standardization* on International Industrial Power *more profitable than ever.*

Three of these new "I" models have carburetor-type engines—two have International quick, easy-starting, *full* Diesel engines. They are streamlined, efficient, economical—ready to cut costs to the bone on a wide variety of jobs.

Contractors, counties and townships, cities and villages, airports, parks, cemeteries, golf courses, railroads, public utilities, factories, lumber and building supply yards, etc., will find these new Internationals useful, handy, and economical on a wide variety of construction, maintenance, materials-handling, and transportation work.

All these tractors have Tocco-hardened crankshafts, pressure lubrication, replaceable cylinders, five forward speeds up to 15 m.p.h., gear drive, countershaft brakes that can be individually controlled or interlocked, provision for mounting a variety of allied equipment, and many other features.

See these tractors at first hand. Watch them perform on the job. Ask the nearest International Industrial Power dealer or Company-owned branch for full information.

**INTERNATIONAL HARVESTER COMPANY**
**180 North Michigan Avenue, Chicago, Illinois**

### "I" Tractor Facts

I-4—4-cylinder valve-in-head gasoline engine. Bore and stroke 3⅜ x 4¼ in. 5 forward speeds up to 15 m.p.h. Develops 29.5 engine h.p. at 1,650 r.p.m.

I-6—4-cylinder, valve-in-head gasoline engine. Bore and stroke 3⅞ x 5¼ in. 5 forward speeds up to 14 m.p.h. Develops 40.5 engine h.p. at 1,450 r.p.m.

ID-6 DIESEL—Quick-starting, 4-cylinder, compression-ignition, 4-cycle Diesel engine. Bore and stroke 3⅞ x 5¼ in. 5 forward speeds up to 14 m.p.h. Develops 38.5 engine h.p. at 1,450 r.p.m.

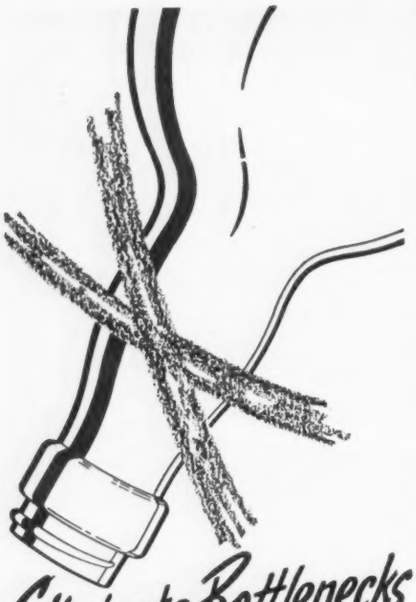
I-9—4-cylinder, valve-in-head gasoline engine. Bore and stroke 4.4 x 5.5 in. 5 forward speeds up to 15 m.p.h. Develops 54 engine h.p. at 1,500 r.p.m.

ID-9 DIESEL—Quick-starting, 4-cylinder, compression-ignition, 4-cycle Diesel engine. Bore and stroke 4.4 x 5.5 in. 5 forward speeds up to 15 m.p.h. Develops 51.5 engine h.p. at 1,500 r.p.m.

### "I" Tractor Applications in the Public Utilities Field

Public utilities and telephone companies will find the new "I" tractors practical for handling materials in shops, pulling trailer trains, laying and pulling cable, stringing lines, operating cranes and hoists, and for snow removal work.

# INTERNATIONAL Industrial Power



Eliminate Bottlenecks in Your Power Expansion PROGRAM...

**Southern States' engineers ★ substation designs ★ manufacturing facilities are at your disposal to help you capacitate your system to meet demands of our nation's Defense Program.**

**Southern States can supply you with equipment ranging from *one fuse link* to a *complete substation* designed to fill your requirements.**

**Write Southern States for quotations as needs for new equipment arise.**

1941-Our 25th Year

Southern States

EQUIPMENT (SS) CORPORATION

28 S. 20th St. Birmingham, Ala.

*Representatives in Principal Cities*

EVIDENCE of Southern States' ability to eliminate your bottlenecks in this 110 kv. station just completed at Camp Shelby, Miss. Designed and fabricated by Southern States.

Write for your Catalog Now!

# Field Reports on Business

*Strong utility buying has been noted, with industrial and government orders swelling backlog of manufacturers. Markets for electrical appliances have been strong with sales reaching new high levels. Some shortages have been noted in the appliance lines. Inventories are expanding.*

## NEW ENGLAND

The influx of orders for New England industries indicates a slight leveling out of the trend developed during the first quarter of this year, but a strong demand for electrical equipment still prevails and huge backlogs are reported from many sources. Textiles are buying steadily in the electrical market; a western Massachusetts mill bought a 750-kva. generator last week and a Rhode Island mill a 350-kva. unit a short time ago.

Central station equipment and supplies are in good demand. A large group of insulators for northern New England line extensions totaling in the neighborhood of $30,000 was placed a short time ago and about $20,000 in switches and circuit breakers was booked by a well-known manufacturer. Eastern Malleable Iron Co., Naugatuck, Conn., has installed a 450-kw. indirect arc furnace and Grainger Rush Co., Boston, has been awarded a $2,031 circuit breaker order.

Defense program orders received in this area recently include electric cable, Collyer Insulated Wire Co., Pawtucket, R. I., about $130,000.

Arc welding is very active and 200-amp. units and up are in strong demand. A 125-hp. commercial refrigerating unit was installed in the Boston area recently and 100 hp. in small motors sold to a large food supply company of eastern Massachusetts. American Steel & Wire will soon start construction on a new strip finishing mill at Worcester to cover 14 acres and cost about $1,000,000.

## PACIFIC COAST

March was featured not only by defense business from specific sources but also by utility efforts to anticipate a peak demand of several years hence. Pacific Gas & Electric Co.'s $60,000,000 investment program, begun in 1939, provides for a dry-year system capacity of 1,680,000 kw. in 1944, last year's maximum demand being 1,125,700 kw. Other indications are new substations, telephone exchanges and railroad stations, as at Palo Alto and Salinas on the Southern Pacific, whose central track control near Shasta Dam will cost $133,580 to construct and about as much more for its electric equipment.

Utilities have been anticipating their year's requirements of brass and copper terminals and connectors because of a threatened brass shortage. The recent 3 per cent price increase in rubber and lead cables produced very little special business. The Shoshone project is buying 1,500,000 ft. of stranded copper cable and Shasta Dam requires 3,000,000 ft. of 1-in. black pipe and 290,000 couplings. San Francisco substation enlargements require three 3,333-kva. transformers and $50,000 of 750,000-circ.mil triplex 15,000-volt cable. The industry-wide electric range and water heater campaign is setting new records for immediate sales and installations.

Recent orders cover three 12,000-kva. Westinghouse transformers, costing $53,298, for Tacoma; a group of 333- and 500-kva. Allis-Chalmers transformers, costing $13,538 for Burbank; a $20,594 control switchboard for Parker Dam, Ariz.; a $54,785 power plant at Wendover Bombing Range, Utah, and $57,491 for the 115-kv. Elephant Butte transmission lines.

## NEW YORK

Business is feeling more the effects of the $11,884,000,000 contract awards of the Army and Navy up to March 8. This is 72.6 per cent of the program. Navy contracts awarded last week call for $669,089 of electric cable. Industrials and utilities are ordering a variety of equipment.

The priorities division is preparing a bill to give it authority over prices, priorities and control of private inventories of strategic raw materials. Tungsten is the latest material to go on the priority list and others are to follow soon.

Electric refrigerator sales show sharp advances, with stocks getting low. Some dealers report difficulty in getting shipments as demand grows. So far this year total sales have reached new high records. Electric ranges and small appliances continue in demand, with sales hitting new highs. Possibilities of price increases are seen.

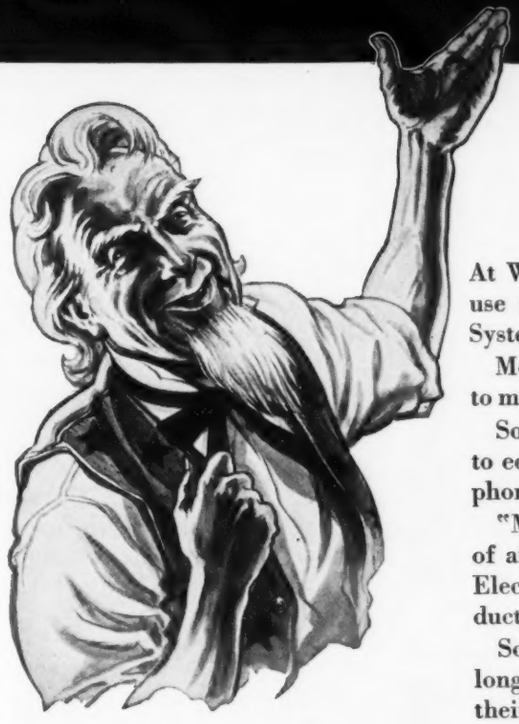
Engineering construction awards for last week totaled $126,248,000, a gain of 181 per cent over the 1940 week and 41 per cent higher than a week ago, reports *Engineering News-Record*. Private construction is expanding. In this area several new housing developments are planned. Manufacturing plants are expanding to meet defense production.

## CHICAGO

Utility buying is strong throughout the Middle West as numerous projects are now in progress or getting under way to provide additional generating capacity and extend transmission lines. With industrial activity steadily increasing to near capacity levels, the demand for electric power continues to widen the margin of gain over a year ago. Manufacturers report further increase in the volume of new orders for electrical equipment from defense contracts and industrial plant expansions.

Construction of additional manufacturing facilities in this area during the first quarter involved an investment of $79,386,000, as compared with $16,406,000 in the same period in 1940. Birtman Electric Co. plans to spend $250,000 for a plant addition, while the Belden Manufacturing Co. will build a $100,000 addition to its Richmond, Ind., plant. Cutler-Hammer, Inc., will spend $20,000 for expansion at Milwaukee, Wis. Kellogg Switchboard & Supply Co. is buying a sizable amount of new machine tool equipment to increase production on large defense orders.

Industrial Truck Statistical Association reports a record volume of orders booked for electric trucks as the February total showed an increase of 505 per cent over the same month last year. Defense contracts placed here last week totaled $5,751,000, including orders with electrical manufacturers for motor-generators, $32,223; wire and cable, $28,710; switchboards, $23,736; pole line equipment, $11,210; motors, $8,894.



## "and that's good news for the National Defense!"

At Western Electric we're producing telephone equipment for use now which normally would not be required for the Bell System's nationwide service for two or more years.

More than a year ago we began to plan for the impending need—to make ready our people, our plants, our machines, our materials.

So we're prepared when a rush order comes from Uncle Sam to equip Camp Edwards or Camp Beauregard with adequate telephone facilities. Thirty million feet of wire? Yes, in a single order.

"More telephones for these new plants," is the urgent demand of aircraft manufacturers and other defense industries. Western Electric's response cuts weeks and even months out of usual production schedules.

So in this time of need, as in calmer days, Western Electric's long experience and manufacturing facilities are demonstrating their worth to the nation.

# *Western Electric* *. . . is back of your Bell Telephone service*

# PAGE FENCE

*America's First Wire Fence—Since 1883*

**ITS STRENGTH IS IN ITS SHAPE**

★ Pound for pound, Page Winged Channel Posts—specially developed for use with chain link fence—are strongest and render longest service. Their shape gives them greater resistance to pull and strain, and thus they help to safeguard your investment in property protection. But a better post is but one advantage you get from Page. Only Page provides localized engineering and erecting service. Page Fence is distributed by 102 responsible firms which own and operate their own plants—local business men, technically trained, long experienced and permanently interested in every job they handle. Write for copy of book, "Fence Facts," and name of nearest Page Fence distributor. Address—PAGE FENCE ASSOCIATION, Monessen, Pa., or Bridgeport, Conn., New York, Pittsburgh, Atlanta, Chicago, San Francisco.

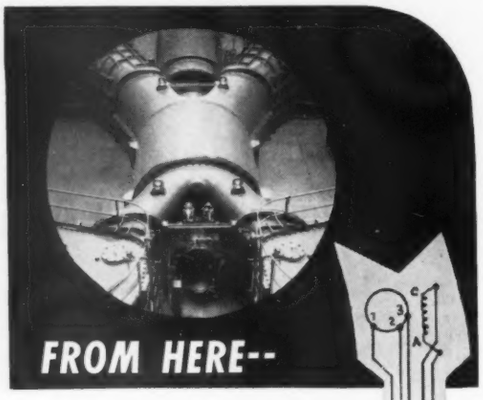
A PRODUCT OF PAGE STEEL & WIRE DIVISION—AMERICAN CHAIN & CABLE COMPANY, INC.



*Remote readings*

by means of

# BENDIX AUTOSYNS




The circuit diagram in the arrow shows how simply a pair of Bendix-Cory Autosyns transmit instrument readings to remote points. Pressure, station load, r.p.m., position, rate-of-flow, count, dimension, liquid level—almost any measure—may thus be read at a distance in one or several places. Several sizes and types. Type 851 (shown) produces 2.5 inch-ounces of torque at 90° angular displacement—safe continuous operating torque 1.1 inch-ounces. Weight 15.3 ozs. Dimensions 2¾"x3 15/32". Other Autoyns operate within an accuracy range of 1° + or — (½° + or — on special order).

BENDIX AVIATION CORPORATION

MARINE DIVISION

754 Lexington Ave., Brooklyn, N. Y.


## Wind, Flood Precautions Mark Coast Plant Design

[*Continued from page 57*]

only in sight of the boiler room operator but can communicate instructions back and forth by means of a loud-speaker system. Doorless, soundproof communication booths are provided at each operating center. This arrangement is made possible since no curtain wall was considered necessary with gas-fired boilers.

A ventilating system is used to purge the operating area, which is in the basement or pit of the plant. A 30,000-c.f.m. fan circulates filtered air into this area. The air circulating system makes for the comfort and efficiency in operation of the operating crew.

The general plant layout is arranged for three additional units, one of which is scheduled for installation in 1941. The west wall of the building is constructed of 4-in. x 18-in. precast concrete slabs which will be moved forward and reused with each extension. The present building has a total volume of 45.08 cu.ft. per kilowatt, 19.9 cu.ft. is in boiler room, 13.6 cu.ft. in turbine room, 7.64 cu.ft. in machine shop and storage area and 3.94 cu.ft. in office, lavatories and switch room.

### *Electrical System*

The output of each generator is through two paths. No bus is provided for the generator voltage of 13,800. Leads from each generator are connected to a 6,000-kva., three-phase auto-transformer transforming to 12 kv. for local distribution and to three 3,334-kva., single-phase outdoor transformers stepping up to 69,000 volts for the interconnected transmission system. A cubicle switchboard located on the 1-ft. 6-in. operating floor contains circuit breakers and bus for the 12-kv. system. Four feeders are provided at present, three of the feeders going underground and under the ship channel to the south side, where they connect to two local overhead lines. The fourth feeder feeds the Corpus Christi area north and east of the power plant, connecting to a 12-kv. overhead line in front of the plant.

The six 69-kv. outdoor transformers are connected to two circuits forming a loop to a switching station located at the west boundary of Corpus Christi, where connection

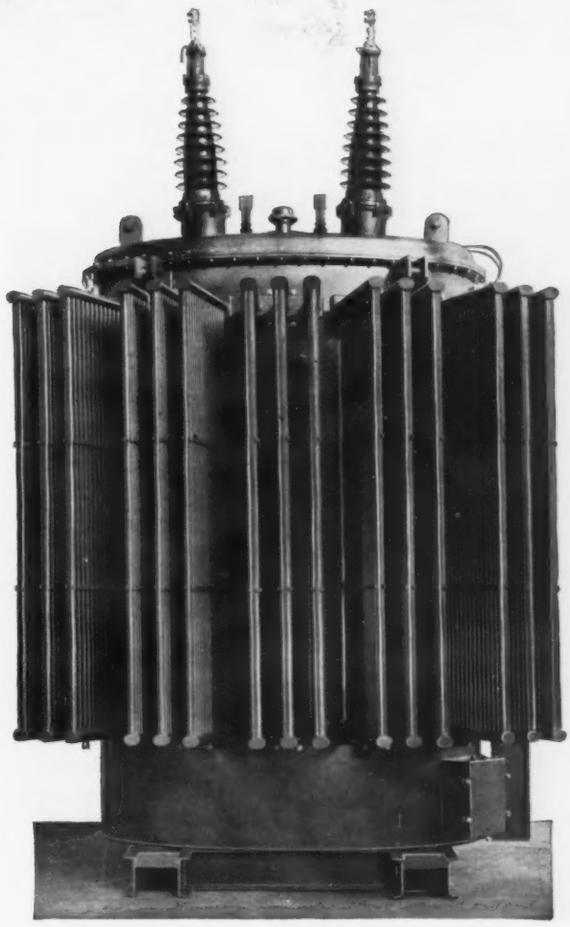
# Right now's when you need fast service - believe me Pennsylvania can give it!

Right now is when you appreciate SERVICE the most! This means, as Pennsylvania sees it, not merely speed in delivery, but a *complete service*, geared to your present-day demands!

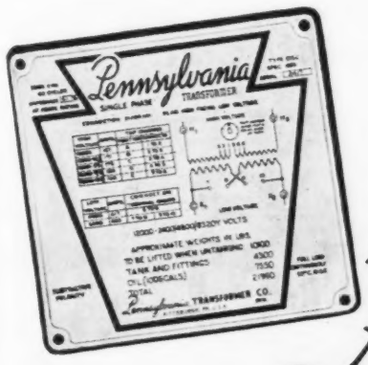
The present defense program, with its consequent deluge of rush orders, finds Pennsylvania fully prepared to render the same thorough co-operation it has always accorded its customers.

Its compact, closely knit organization is trained and experienced, willing and eager to extend the utmost in technical assistance. This is of supreme importance in times like the present, when *you cannot afford to sacrifice efficiency for speed.*

*Let Pennsylvania prove its fitness to solve your transformer requirements, no matter how complex the problem or how demanding the delivery schedule!*



**An instance of Pennsylvania co-operation . . . this is one of nine transformer on an order for a total of 90,000 kva. The customer ordered six, and, upon completion, duplicated the order for three more, all being produced in record time.**




## Look for this nameplate

*It is a distinguishing mark of quality on transformers . . . not only an assurance of dependability but a symbol of complete service to transformer users!*

Pennsylvania TRANSFORMER COMPANY

1701 ISLAND AVENUE, N. S., PITTSBURGH, PA.

# NEW
## Compact Pressure Switch

## For Automatic Control of Small Water Pump, Pneumatic and Oil Systems

Jefferson pressure switches are designed to operate motors in either hydraulic or pneumatic pressure systems where accurate differential settings are essential.

Enclosing case removed.

The simplicity of construction requires a minimum of movable parts insuring compactness, accuracy and dependability. The gear rack is brass, — over-size contact points of silver composition resist freezing and pitting—and insure positive contact.

Differential settings may be provided as required—and the pressure range may be easily adjusted for predetermined values. The maximum working pressure range is 80 pounds.

Details are contained in Bulletin 401-PVS . . . Fill in and mail the coupon below. JEFFERSON ELECTRIC COMPANY, Bellwood (Suburb of Chicago), Illinois. Canadian Factory: 60-64 Osler Avenue, W. Toronto, Ontario.

**JEFFERSON ELECTRIC**

**PRESSURE SWITCHES**

JEFFERSON ELECTRIC CO., BELLWOOD, ILL.

Please send copy of Bulletin 401-PVS and other Jefferson Electric Controls to:

Name.....

Company Name.....

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City..... State.....


is made to the interconnected transmission system. The circuit going west from the plant substation is an overhead H-frame pole line. The south and east part of the loop circuit is connected to a 69-kv. oil-filled submarine cable at the south side of the ship channel which terminates in the plant outdoor substation. A spare cable has been provided. Both 69-kv. submarine cables were laid under the channel in the same 50-ft. deep trench with the 12-kv. feeder cables and the 10-in. cast-iron city water line. Two additional 69-kv. overhead lines are to be constructed before the end of 1940 going north from the plant, crossing Nueces Bay. These lines will be connected to another point of the interconnected transmission system, providing loop service to several outlying communities.

Two 1,000-kva., three-phase, 13,800-460-volt auxiliary transformers are connected direct to the turbo-generator leads, providing service for the plant auxiliaries and lighting through additional step-down transformers. The various station auxiliaries and mechanical equipment, with the exception of one 230-g.p.m. steam-driven boiler feed pump are electrically driven.

•

## Westinghouse Employees Get 9% Bonus Payment

Westinghouse Electric & Manufacturing Co. adjusted upward 9 per cent in March the wages and salaries of employees in accordance with the bonus plan. In February the increase was 8 per cent.

Based on monthly earnings figures, net profit for the company for the two months ended February 28 was $3,571,765 after taxes and charges, equal to $1.33 a share on combined preferred and common stocks. This compares with $2,234,975, or 83 cents a share, on combined shares for the first two months last year. February net profit was $1,840,790, against $1,276,234 in February, 1940, and $1,730,975 in January, 1941.

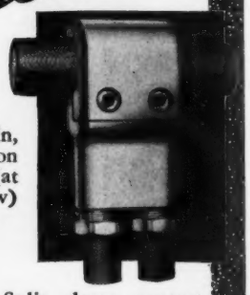
•

## Moves Sales Office

Reflecting the sharp upswing in industrial activity, the increased demand for Cutler-Hammer control equipment has necessitated moving the company's Indianapolis sales office to 241 N. Pennsylvania Street, Room 316.


The MOST COMPLETE LINE OF

# Tee Connectors



ALL good types —any size.

With a *hinged clamp* for the main, the Penn-Union Type HFM (at right, and below) is easy to apply.

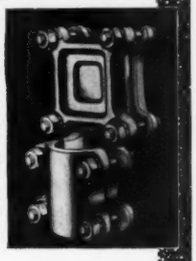
Split sleeve contact unit gives permanent grip on branch.

Made for single or multiple branch connections.

ALSO CABLE TAPS — a complete line of 90° and Parallel taps, for one or more branches.

COMPACT and POSITIVE. The Penn-Union Type SM gives equal tightening on the run and tap. Self-locking, dependable.

CLAMP TYPE TEES for all sizes of tubing and cable—a full line. Machined contact surfaces.



MANY MORE TYPES—for all combinations. For connecting flat bar, run or tap, to tubing or cable. Also "general utility" tees that take a wide range of conductor sizes. You will find that the Penn-Union line has *exactly what you need.*

FOR ANY CONDUCTOR FITTING—Terminals, Service Connectors, Studs, Two-Ways, Ground Clamps—see the THOUSANDS in the Penn-Union Catalog.

Preferred by the largest users, who have found that *Penn-Union on a fitting is the best guarantee of Dependability.*

***Sold by Leading Jobbers***

Write for Catalog

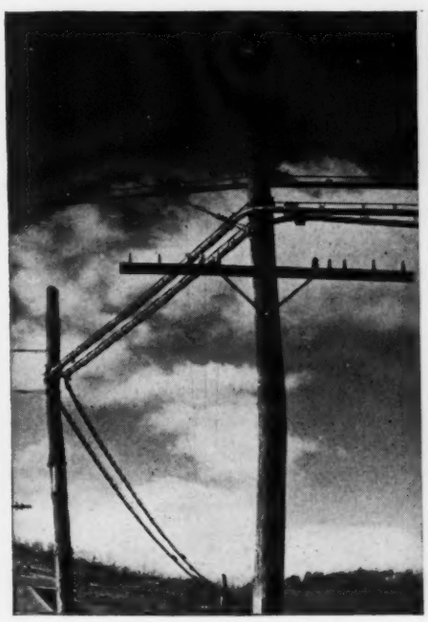
**PENN-UNION ELECTRIC CORPORATION**

**ERIE, PA.**

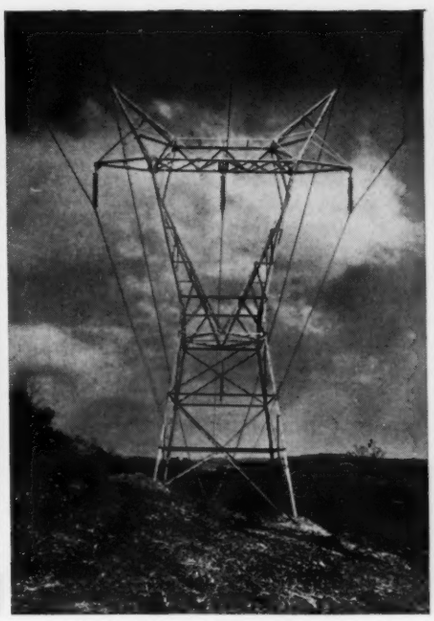
**PENN-UNION**

**Conductor Fittings**

# Facts on bethanized strand every line designer should know



**Messenger Strand**



**Static Wire**

**Guy Wire**

Until a few years ago, there was no way of exactly matching the life of messenger strand, static wire or guys to the economic life of a line. If the life of double galvanized strand equalled the probable life of the line, all well and good. If not, some type of non-ferrous or composite strand had to be used, regardless of cost.

Bethanized strand has changed this picture. Bethanized strand offers the line designer three different coating weights. "A"—the equal of standard double-galvanized. "B"—twice as heavy. "C"—three times as heavy. With these three coating weights to choose from, the designer can specify strand that will last as long as the line; in mill areas, near railroads, or out in the country. Frequent replacements are eliminated. The expense of special non-ferrous materials is avoided.

Because the coating on bethanized strand is applied electrolytically, it is tighter, purer, more uniform than any other zinc coating on the market. No thin spots give corrosion an opening. Splicing, serving or twisting will not flake the ductile bethanized coating.

Bethanized strand is available in all strengths—Standard, Siemens-Martin, High Strength, Extra High Strength, and Specification (Utility grade). Many companies are specifying High Strength strand because it gives them more breaking strength per dollar and per pound. They use the "B" or "C" coating to insure corrosion resistance equal to that of the larger-sized lower-strength grades. High Strength strand, being smaller, lightens its own load. Furthermore, it is less apt to snap in an ice storm because its smaller size collects less ice.

**BETHLEHEM STEEL COMPANY**

BETHLEHEM STEEL

# *NEW* THE IMPROVED CHICAGO GRIP FOR HOT OR DEAD LINES

*"Since 1857"*

SLIP this grip on the line — the safety latch holds it fast. It can be applied close to the pole and slid out the required distance—and it can't fall off accidentally.

The harder the pull — the tighter it holds. The Improved Chicago Grip is ideal for Hot Lines, too, giving the maximum in safety plus the maximum in convenience.

*A copy of this new folder will be sent on request. Write for Bulletin 3141.*

**ASK YOUR SUPPLIER**

***Foreign Distributor:***

**International Standard Electric Corp., New York**

Mathias KLEIN & Sons

3200 Belmont Avenue, Chicago, Illinois


## Branch-Fuse Policy Set by Fault Ratio

[*Continued from page 62*]

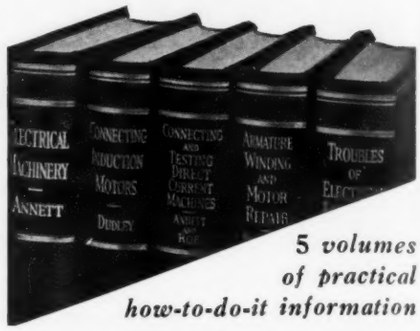
Fig. 1 with the 25 per cent permanent faults as an ordinate, indicates an over-all reduction of kva.-hours outage by the use of a reclosing fuse cutout in the branch line.

The use of branch circuit fuses can be greatly extended by co-ordinating the first opening of the feeder oil circuit breaker with the fuse so that the breaker protects the fuse in its first opening but has sufficient time delay in its control to cause the blowing of the fuse on permanent faults before subsequent reopening. Speed of breaker opening necessary for successful operation depends on the relative value of the maximum short-circuit current in the branch circuit with respect to the fuse rating. For instance, a total clearing time including relay and breaker by the order of 2 or 3 cycles is required to protect a branch fuse for a short-circuit current of approximately ten times its rating, whereas a total clearing time of 9 or 10 cycles is required if the maximum short-circuit approximates only about five times the fuse rating. In applications of this type an instantaneous high-speed relay is used for the first opening and the conventional induction-type inverse time-delay relay for subsequent openings. With this scheme of operation the substation breaker clears all temporary faults which disappear after the first interruption of power and the branch line fuses isolate the permanent faults, thus resulting in a minimum of kva.-hours outage.

### *Rule of Thumb*

From Fig. 1 it is possible to obtain a very simple rule of thumb for the application of branch-line fuses. This is that the installation of branch-line fuses will reduce the over-all kva.-hours outage of the feeder whenever the per cent load in the branch is less than the per cent permanent faults in that branch, and under certain conditions even when the per cent load in the branch circuit is slightly more than the per cent permanent faults in that branch. The use of reclosing cutouts and the co-ordination of the feeder circuit breaker with branch-line fuses increase their field of application over that which would be advantageous for the conventional arrangement.


## Every phase of electrical maintenance and repair work covered in this NEW Library




***5 volumes of practical how-to-do-it information***

**Every man concerned with the care and repair of electrical machinery should have these practical books, with their helpful tables, diagrams, data, methods and kinks. Every one of the five volumes is jammed to the covers with sound, how-to-do-it information—the kind you have to have when anything goes wrong. Liberal use has been made of practical data and practice in repair shops so as to combine the good features of a library of methods with handbook information covering these methods.**

## Electrical Maintenance and Repair Library

***2042 pages, 1721 illustrations and diagrams***

***These books show you how to***

—install all types of motor and generator units;
—locate breaks in armature windings and do a workmanlike job of rewinding;
—know just what is wrong with an electrical machine and take charge of installation and maintenance work;
—make accurate tests of switchboards and apparatus and correctly balance the power with the load;
—handle every sort of wiring job;
—show competence, whether it be in the use of a Stillson wrench or a Wheatstone bridge.

### *New trouble-shooting book*

Now, in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a handy book full of helpful maintenance information, special trouble-shooting charts, explanation of symptoms and causes of machinery troubles, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

**10 days' examination**
**Easy monthly payments**

We want you to examine this Library for 10 days. If you don't want the books at the end of that time, there's no obligation to keep them. On the other hand if you decide you want the help these books can give, start the small monthly payments then, and in a short time the books are yours, right while you have been using them. Send the coupon today.

## EXAMINATION COUPON

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**330 W. 42nd St., New York, N. Y.**

Send me Electrical Maintenance and Repair Library, 5 volumes, for 10 days' examination. If I find the books satisfactory, I will send you $1.00 in 10 days, and $2.00 a month until $15.00 has been paid. Otherwise I will return the books postpaid.

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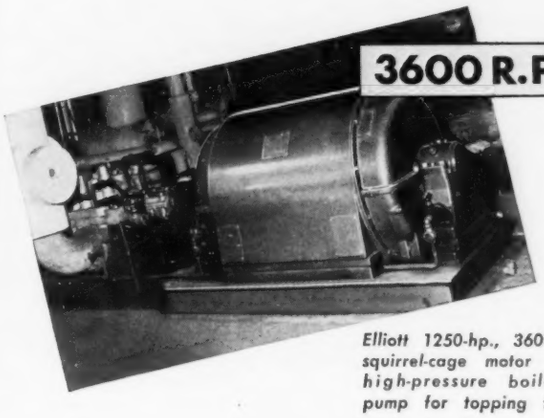
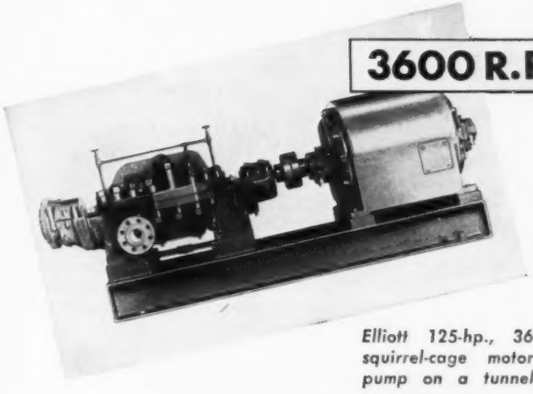
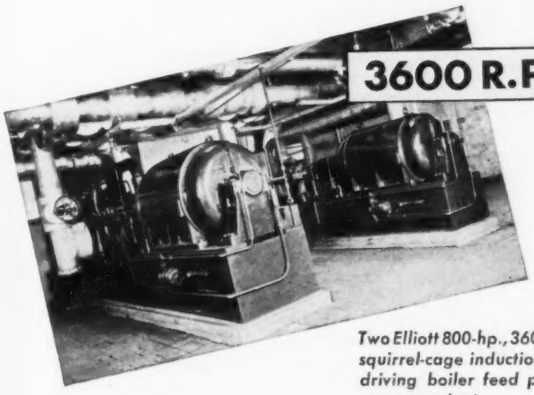
# Driving Big Pumps at 3600 R.P.M. calls for ELLIOTT MOTORS




*Elliott 1250-hp., 3600-r.p.m. squirrel-cage motor driving high-pressure boiler-feed pump for topping turbine.*




*Elliott 125-hp., 3600-r.p.m. squirrel-cage motor for a pump on a tunneling job.*




*Two Elliott 800-hp., 3600-r.p.m. squirrel-cage induction motors driving boiler feed pumps in a power plant.*

WHEN a 1250-hp., 3600-r.p.m. Elliott motor goes to work on a large pump, it's a safe bet that a lot of gallons per minute are going to start coming through — and keep on coming! These motors have the ruggedness, the ability, to maintain such a standard.

In the field of big, high-speed motors, Elliott stands at the top. Two-pole synchronous and squirrel-cage induction motors have an enviable record of outstanding achievements in installations ranging from utility power plants to underground tunneling jobs.

Elliott motors are designed for the job they have to do whether it's furnishing power for a pump, blower, pulverizer mill, or any other drive over 25 hp.

**Ask the Elliott engineering staff to help on your next motor specification. Write today for interesting, informative bulletins.**

L-724

**ELLIOTT COMPANY**
*Electric Power Dept.*
**RIDGWAY, PA.**
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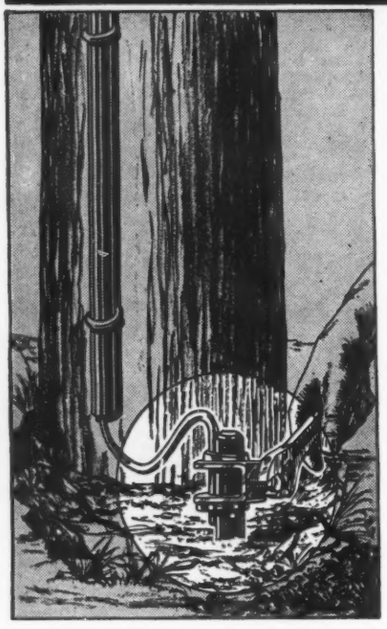
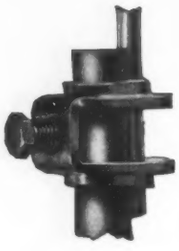
modernize
YOUR DISTRIBUTION PRACTICE—





RELIABLE GROUND ROD CLAMPS

Still out in front.

The first low price efficiently designed Ground Rod Clamp still offers a fine thread screw to apply a really high pressure joint, Everdur material throughout, and a body that springs slightly under stress so it will not vibrate loose. Hollow head set screws when specified.

Reliable ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES
3143 CARROLL AVENUE • CHICAGO ILLINOIS

# Sales Opportunities

NORFOLK, VA.—Virginia Electric & Power Co., Richmond, plans new 33,000-volt transmission line from steam-electric generating plant on Reeves Avenue, Norfolk, to Federal Naval Operating Base in Norfolk area, with a new power substation for terminal service at latter point. Also, will build new power substation at Portsmouth, Va., and make extensions in distribution lines in that district. Cost reported over $200,000. Work will be carried out in conjunction with expansion in generating station noted, now under way, forming part of 1941 extension and improvement program of company.

LAKE MILLS, IOWA—City Council receives bids until April 22 for extensions and improvements in municipal power station, including installation of additional equipment.

DENVER, COLO.—Bureau of Reclamation, Denver, receives bids until April 21 for two 230-kv., 600-amp. oil circuit breakers, and two 115-kv., 1200-amp. oil circuit breakers; five 1200-amp., and five 600-amp., 115-kv. disconnecting switches, for Grand Coulee hydroelectric power station, Columbia Basin project, Wash.

MEMPHIS, TENN.—Fisher Body Division, General Motors Corp., General Motors Building, Detroit, Mich., plans installation of motors and controls, switchgear, transformers and accessories, duct lines, industrial lighting system, electric hoists, conveyors and other equipment in new addition to branch plant at Memphis, totaling about 600,000 square feet of floor space, for production of parts for twin-engine bombing planes for War Department. Government will provide fund of $6,875,000 for project, of which about $4,475,000 will be used for equipment purchases. Work is scheduled to begin soon.

MONROE, LA.—City Council plans expansion and improvements in municipal power plant and electrical distribution system, including new primary and secondary lines, power substation extensions, service connections and other operating facilities. Bond issue of $875,000 has been authorized for work.

CRYSTAL FALLS, MICH.—Wisconsin-Michigan Power Co., Appleton, Wis., will have plans prepared soon for three hydroelectric power developments in Iron County, Mich., for which permission has been secured from Iron County Board of Supervisors, comprising stations at Peavy Falls, Michigamme Falls and Hemlock Falls, respectively. Proposed plants will have installed capacities of 22,500-hp., 11,400-hp., and 6400-hp., in order noted. A transmission line will be built to tie-in the three stations, as well as for connection with present high-tension system in this locality. Cost estimated over $3,000,000.

MONTGOMERY, ALA.—Constructing Quartermaster, Maxwell Field, Montgomery, receives bids until April 11 for 83,650 lineal feet of rigid steel zinc-coated electrical conduit, 204,000 lineal feet of copper wire, 3750 outlet boxes, quantity of porcelain bracket fixtures, conduit couplings, switches, load centers, rubber insulating tape, box cleats, etc. (Circular 6425-63).

CLARION, PA.—Pennsylvania Electric Co., Johnstown, Pa., has approved plans for immediate construction of new power substation at Clarion. Cost estimated at close to $50,000.

AKRON, OHIO—Goodyear Aircraft Corp., East Market Street, recently organized subsidiary of Goodyear Tire & Rubber Co., same address, plans installation of motors and controls, switchgear, duct lines, industrial lighting facilities, conveyors, electric hoists and other equipment in new plant for production of parts for military airplanes for Government. It will consist of main one-story unit and adjoining smaller structures. Cost close to $1,000,000.

ST. BERNARD, OHIO—City Council will take bids soon for extensions and improvements in municipal power plant, including installation of additional equipment for increased capacity. Cost about $125,000. Appropriation in that amount has been arranged.

FOSTORIA, OHIO—National Carbon Co., Inc., 30 East Forty-second Street, New York, N. Y., manufacturer of carbon and graphite products, etc., plans installation of motors and controls, switchgear, duct lines, regulators, industrial lighting system, conveyors and other equipment in one-story addition to branch plant at Fostoria, to be used for production of gas mask charcoal for Government. Structure will be owned by War Department, which will provide fund of $957,000 for project, and operated by National company. Erection is scheduled to be carried out at once by Gillmore, Carmichael, Olson Co., 1873 East Fifty-fifth Street, Cleveland, Ohio, contractor.

DENVER, COLO.—Bureau of Reclamation, Denver, receives bids until April 28 for one 40,000-hp. vertical-shaft, hydraulic turbine, and for one oil-pressure actuator-type governor, for installation in Parker hydroelectric power plant, Parker Dam project, Arizona-California.

ALEXANDRIA, LA.—Louisiana Power & Light Co., New Orleans, will make extensions in transmission and distributing lines for power supply for new Federal munition plants and camps in this and neighboring areas, including power substation units for distribution and service facilities. Also will extend lines for service at Camp Polk, vicinity of Alexandria. Cost estimated at $235,000 and contract has been made with Government at that figure to proceed with work at once.

CHICAGO, ILL.—Commissioner of Subways and Superhighways, 20 North Wacker Drive, receives bids until April 17 for furnishing and installing electrical equipment for State Street subway system. This equipment will include conduits, wire and cable, switchboards, electrical cabinets, outlet boxes, electrical fixtures and accessories (Contract E-1).

BRISTOL, PA.—Fleetwings, Inc., Bristol, manufacturer of aircraft, plans installation of power substation equipment, motors and controls, duct lines, industrial lighting system, conveyors, electric hoists and other equipment in new local plant, adjoining present works, for production of aircraft parts for Government. It will comprise several large continuous one-story units, estimated to cost about $2,480,000. Appropriation in that amount will be provided by Government.

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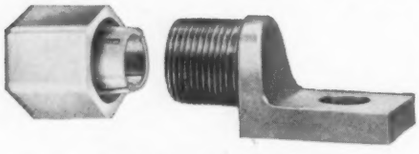

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## New Funds Allotted for Rural Projects

Allotments totaling $708,000 for rural electrification in nine states have recently been announced by the Rural Electrification Administrator. These allotments provide for the enlargement of twelve power systems, of two public power districts, and one refrigeration locker plant.

This brings allotments made by REA since it was established in 1935 to $364,299,621, of which $94,917,500 represents operations of the current fiscal year. Details of the allotments follow:

ALABAMA—Wiregrass Electric Co-operative, Inc., Hartford, $75,000 to build 129 miles of line, 277 members in Geneva, Covington, Houston, Coffee and Henry counties.

CALIFORNIA—Plumas-Sierra Rural Electric Co-operative, Portola; E. J. Shelley, supt., $20,000 to complete the system.

COLORADO—Morgan County Rural Electric Assn., Fort Morgan, William L. Parker, supt., $12,000 to complete the system.

KENTUCKY—Big Sandy Rural Electric Co-operative Corp., Prestonburg, Milt Stanley, president, $100,000 to build 85.5 miles of line, 536 members in Johnson, Martin, Floyd and Knott counties.

LOUISIANA—Southwest Louisiana Electric Membership Corp., Lafayette, Harry B. Bowles, supt., $44,000 to build 52 miles of line, 198 members in Acadia, St. Landry, St. Martin, Lafayette and Vermillion Parishes. Northeast Louisiana Power Co-operative, Inc., Winnsboro, Robert E. Holladay, supt., $40,000 to build 49 miles of line, 146 members in Franklin, Richland, Tensas and West Carroll Parishes.

MISSOURI—Boone County Co-operative Electric Assn., Columbia, R. A. Dinwiddie, supt., $5,000 to complete the system. Howell-Oregon Electric Co-operative, Inc., West Plains, Joe R. Hinds, supt., $100,000 to build 110 miles of line, 358 members in Howell County.

NEBRASKA—Butler County Rural Public Power District, David City, Neb., Lester Trussell, manager, $29,000 to build 41 miles of line, 84 members in Butler and Polk counties. Northeast Nebraska Rural Public Power District, Emerson, Arthur J. Budwig, supt., $36,000 to build 160 miles of line, 321 members in Dakota, Thurston and Dixon counties.

OHIO—Pioneer Rural Electric Co-operative, Inc., Piqua, A. E. Halterman, supt., $17,000 to complete refrigeration locker plant. South Central Rural Electric Co-operative, Inc., Lancaster, Darwin Kindler, supt., $81,000 to build 57 miles of line, 215 members in Perry, Fairfield, Pickaway, Ross, Licking and Hocking counties.

TEXAS—Panola-Harrison Electric Co-operative, Inc., Elysian Fields, K. A. Crawford, supt., $47,000 to build 96 miles of line, 240 members in Harrison and Panola counties, Tex., and Caddo and DeSoto Parishes, La. Grayson-Collin Electric Co-operative, Inc., Van Alstyne, H. P. Block, supt., $52,000 to build 103 miles of line, 300 members in Grayson and Collin counties. Lone Wolf Electric Co-operative, Inc., Colorado City, O. I. Griffin, supt., $50,000 to build 80 miles of line, 187 members in Mitchell, Scurry and Nolan counties.

Other recent allotments include the following:

ALABAMA—Baldwin County Electric Membership Corp., Robertsdale, $75,000 to build 93 miles of line, 243 members in Monroe and Baldwin counties.

CALIFORNIA—Bard Laguna Electric Co-operative, Inc., Bard, J. H. Ogburn, president, $25,000 to build 26 miles of line, 76 members in Imperial County.

FLORIDA—Tri-County Electric Co-operative, Inc., Madison, Thomas C. Morrison, supt., $49,000 to complete the system.

IOWA—Wright County Rural Electric Co-operative, Clarion, George C. Kirstein, supt., $91,000 to build 117 miles of line, 264 members in Wright, Hamilton and Webster counties.

KENTUCKY—Harrison County Rural Electric Co-operative Corp.; Cynthiana, G. L. Bridwell, supt., $40,000 to build 70 miles of line, 210 members in Bracken, Harrison, Bourbon, Pendleton, Nicholas, Scott, Fayette, Grant and Robertson counties.

MAINE—Co-operative to be formed, David Solman, Caribou, Attorney, $2,500 to purchase poles.

MISSOURI—Southwest Electric Co-operative, Bolivar, L. L. Alexander, supt., $86,000 to build 117 miles of line, 354 members in Webster, Dallas, Polk and Greene counties.

MONTANA—Big Horn County Electric Co-operative, Inc., Hardin, Carl H. Meister, supt., $20,000 to complete system.

NEW MEXICO—Central Valley Electric Co-operative, Inc., Artesia, G. E. Kaiser, supt., $16,000 to complete the system.

NORTH CAROLINA—French Broad Electric Membership Corp., Marshall, Mark W. Bennett, supt., $18,500 to build 24.9 miles of line, 109 members in Madison and Buncombe counties.

OKLAHOMA—Harmon Electric Assn., Inc., Hollis, H. G., Templeton, supt., $73,000 to build 113 miles of line, 286 members in Greer, Harmon and Jackson counties, Okla., and Hardeman County, Tex.

OREGON—Wasco Electric Co-operative, Inc., The Dalles, Eric A. Johnson, supt., $10,000 to complete the system.

SOUTH CAROLINA—Marlboro Electric Co-operative, Inc., Bennettsville, E. W. Miller, supt., $69,000 to build 74 miles of line, 301 members in Marlboro and Dillon counties.

SOUTH DAKOTA—West River Electric Assn., Wall, Neil Rounds, supt., $134,000 to build 172 miles of line, 351 members in Meade, Pennington and Jackson counties. Whetstone Valley Electric Assn., Inc., Milbank, Fred Schwandt, president, $151,000 to build 187 miles of line, 378 members in Roberts and Grant counties.

TENNESSEE—City of Bolivar, Tennessee, Ray Black, Mayor, $19,000 to build 22 miles of line, 71 members in Hardeman and Chester counties.

WASHINGTON—Public Utility District No. 1 of Cowlitz County, Longview, John B. Roche, supt., $10,000 to complete the system.

WISCONSIN—Waushara County Electric Co-operative, Inc., Wautoma, John Brooks, president, $25,000 to build 27 miles of line, 62 members in Waushara County. Columbus Rural Electric Co-operative, Columbus, R. H. Roob, supt., $5,000 to complete the system. The borrower previously has been allotted $391,800 to build 377 miles of line, 1,184 members.

Another recent allotment included $250,000 for rural electrification in Texas. This allotment provides for the construction of a generating plant and transmission lines by the Farmers Electric Generating Co-operative. Gilmer, Tex., H. P. McGaughy, president.

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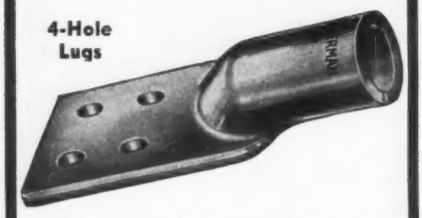

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## New Utility Bills

Action has been taken on the following utility bills in the various state legislatures:

INDIANA—Legislature has overridden a veto of Governor Henry F. Schricker of House Bill 4, which abolishes the Indiana Public Service Commission as organized by the 1933 legislature and creates a new commission under a different set-up. The new bill, which goes into effect May 1, terminates all appointments under the old act and creates a new three-member commission, no more than two of the same political party, to be named by the Governor, Lieutenant-Governor and treasurer of state. One member is to be named chairman. Commission members may be removed by the appointing board for incompetency, inefficiency or neglect of duty. The commission is required to make a survey of utility laws and file a report with the speaker of the House and Lieutenant Governor of the 1943 Legislature and to the Governor ten days before the opening of the session. Members of the House passed the bill over the veto by a vote of 60 to 32 and the Senate by a vote of 28 to 14. Heretofore the Governor had sole power in naming commission members. It is practically certain that suits will be filed in circuit court in Indianapolis testing the validity of the measure. The Governor has signed a bill which amends the 1939 public utilities law and gives the Indiana Public Service Commission and Securities and Exchange Commission authority to determine the ratio of bonds and preferred stock to common stock for additions and improvements (ELECTRICAL WORLD, March 22, page 136). The Governor has also signed Senate Bill 98 which permits use of short wave radios, capable of receiving police broadcasts, by any service, maintenance or construction truck, or emergency or other vehicle operated by a public utility company, or by any street car, trackless trolley or motor bus operated within a city. Backers of the measure contended that with the large fleet of trucks operated by all utilities their drivers could be of invaluable aid to police if they knew what was going on. Heretofore the use of such radio sets has been banned on all cars and trucks.

IOWA—Senate has voted a two-year extension of Rural Electrification Administration lines from property taxation. The bill, passed by the Senate without dissenting vote, has yet to receive approval of the House. Beginning as a proposal to tax REA plants and lines by a one per cent gross receipts tax instead of property tax, the bill ended up as one to exempt the transmission lines from property tax which would otherwise be payable in 1942 and 1943. After that time the lines will be taxed as the Iowa law provides for co-operative ventures of the kind, unless the next legislature extends the tax relief over more time.

MICHIGAN—A bill that would make it a felony to agitate virtually any strike by public utility workers was introduced recently in the Michigan state legislature by Loomis K. Preston of St. Joseph. The bill, according to its author, was inspired by the recent threat of Consumers Power Co. employees to strike. This bill would make it a felony for any person not the employer to persuade anyone to leave his employment while he is engaged in helping furnish electricity, gas, heat or water to any hospital or old people's home.

NORTH CAROLINA—High Point's latest effort to clear the way for erection of a PWA-financed hydro-electric power plant (ELECTRICAL WORLD, March 22, page 137) was lost recently at the hands of House judiciary committee No. 2, of which Representative Rupert Pickens of High Point, Guilford County, is chairman. The city sought a new law to relieve it from having to get a certificate of convenience and necessity for its project. The committee considered the measure in a two-hour executive session, then voted 10 to 8 to report it unfavorably. It would take a two-thirds vote of the house members to put the bill on the favorable calendar for debate and action.

OREGON—Representatives of public power systems and private utilities operating outside Multnomah County appeared at a hearing called by the state house taxation and revenue committee recently in opposition to a bill to levy a 12 per cent tax on the sale of electric energy. The committee subsequently voted to pass out favorably an amended bill which would levy a 12 per cent tax against electricity retailed by public systems. Opponents of the bill at the hearing charged that it would benefit the big Portland companies, Portland General Electric and Northwestern Electric, at the expense of public systems and smaller upstate privately owned power companies. The proposed bill, a substitute for a measure introduced by Senator Ronald Jones and Representative Angus Gibson, would levy a 12 per cent tax on retail electric energy, to be paid by the seller. The tax would be in lieu of ad valorem taxes assessed on property used in the generation and distribution of electricity. Companies would be required to reduce their rates to consumers in proportion to the benefit, if any, resulting from the changed tax status. As amended, privately owned power companies would continue to pay ad valorem taxes, but public agencies not on the real property tax roll would pay the 12 per cent levy. A bill introduced in the Senate provides for the organization and conduct of electric co-operative non-profit membership corporations. Under the terms of the bill a co-operative can build electric generating plants, buy them, issue notes and bonds. The bill specifically states that "co-operatives doing business in this state pursuant to this act shall be exempt in all respects from the jurisdiction and control of the public utilities commissioner." The fact was brought out clearly at a session of the senate committee on railroads and utilities by Gus Solomon, Oregon Commonwealth Federation, who appeared before the committee instead of Senator Kenin, who had introduced the bill, that the federal Rural Electrification Administration is the sponsor of the bill. Mr. Solomon said he did not know that the bill was a counterpart of one of the five "Ickes bills" sent by the Secretary of the Interior as "must" bills to the 1935 regular session, but not passed by that session.

UTAH—Governor Maw recently caused to be introduced in the state legislature a bill for widespread reorganization of the state government. Among other features would be the setting up of a department of business regulation, which would be headed by a bipartisan board of three full-time commissioners, and would take over functions of state bank commissioner, insurance commissioner, trade commission, public service commission, department of registration, securities commission, and liquor control commission. With approval of the governor, the board could appoint a public utility administrator, a liquor control administrator, and a bank, insurance, and securities administrator or administrators.

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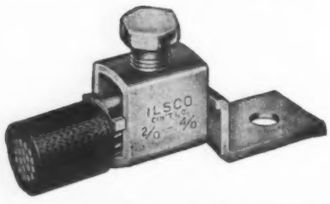

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# LETTERS TO THE EDITOR

## A.I.E.E. Circuit Breaker Discussion

*To the Editor of* ELECTRICAL WORLD:

We wish to thank you for the generous space devoted, in your February 8 issue, to reporting Mr. Edsall's and my own comments on the outdoor air-blast circuit breaker papers presented at the A.I.E.E. midwinter convention in Philadelphia. Unfortunately, however, the report appears to contradict itself and hardly covers the facts as we stated them.

The first sentence of your report makes it appear that the Allis-Chalmers air-blast circuit breakers were developed "following European dictators' orders," and the final sentence gives the impression that Mr. Edsall questioned "whether *oil* breakers are really adequate and whether the industry can really afford them."

Actually, Mr. Edsall drew attention to the fact that developments and improvements of large outdoor oil circuit breakers had continued to the point where, when it was remembered that quick production was essential for defense, it was questionable whether high-tension air-blast or oil-poor breakers could offer greatly improved performance, or whether the industry could afford them at this time.

My own remarks referred to Allis-Chalmers leadership in American oilless circuit breaker design as evidenced by the record of papers on oilless circuit breakers submitted to the Institute since the spring of 1939. I also made reference to the desirable design and performance characteristics of high-tension air-blast circuit breakers.

H. W. MARTIN,
Boston Works
Allis-Chalmers Mfg. Co.

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## Trained Men

*To the Editor of* ELECTRICAL WORLD:

Your editorial in the ELECTRICAL WORLD for March 8, entitled "Trained Men," strikes a very responsive chord in the hearts of the teachers of engineering who have seen precisely the neglect of engineers during the period from 1930 to 1396 which your editorial describes.

It is very difficult for any of us to secure a hearing from the responsible officials in the thousands or more companies which employ our graduates, as we would be immediately discounted as having a selfish interest in the proper distribution of our product, engineering graduates. For you to broadcast this message as you have will guarantee its entry into many important circles. It is sufficiently strongly phrased so that it should result in some action, so that when the slump following the defense boom comes perhaps there will be a more intelligent absorption of our graduates than in the period 1930–1936. We who are close to the problem feel that it is of such importance as to merit occasional repetition, and I hope that you may be led again in the future to refer to it.

H. W. BIBBER,
Professor of Electrical Engineering
Ohio State University, Columbus.

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## Welcomes Operating Article

*To the Editor of* ELECTRICAL WORLD:

The article "Circumstances Attending a Major Metropolitan Disturbance" (ELECTRICAL WORLD, February 22, 1941) forges the link between operation and engineering. To an operator this article is akin to a miracle and there's a crying need for such information about troubles. Too often when things like this happen the fruits of the investigation repose with the operating and engineering supervisors. The man at the controls would benefit and operation and design would benefit if such facts could be more widely and frequently disseminated.

Thanks for a mighty fine operating article.

EDSON E. HOULE,
Manchester, N. H.

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## Army Engineers

*To the Editor of* ELECTRICAL WORLD:

In all my fifty-three years of existence I have never before written to "The Editor," but after reading the article on page 50 of the January 25 issue of ELECTRICAL WORLD, by your reporter Carter Field, I cannot restrain a protest against the implications contained in this article regarding the Army Engineers.

According to your reporter, and published in your magazine, one would get the idea that the Army engineers recommend projects and appropriations for purely personal and political reasons.

I have dealt with this department of the government for some years and, while having some friends among them, have always found that they make up their own minds and are a pretty tough bunch to convince unless you have the goods.

Especially at this time, when we must have confidence in our govern-

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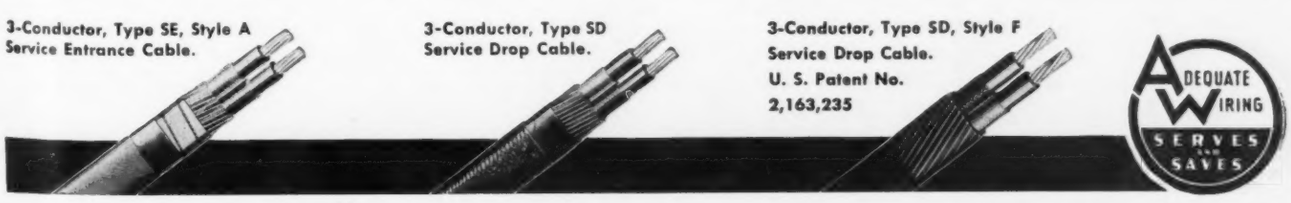


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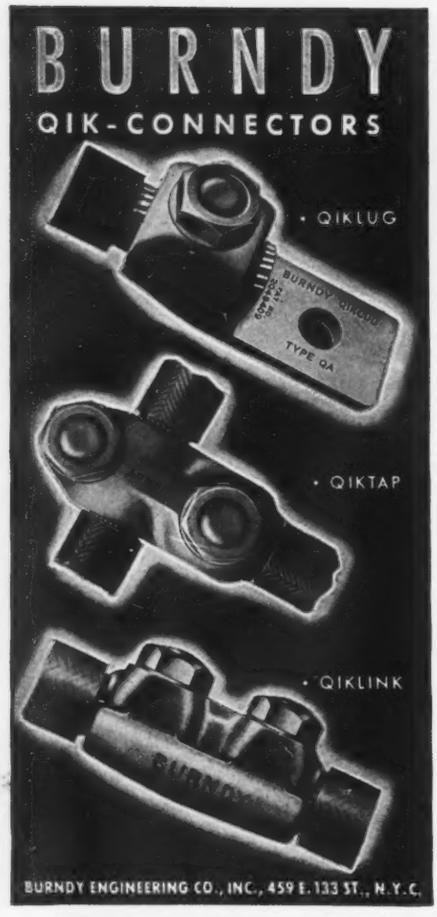


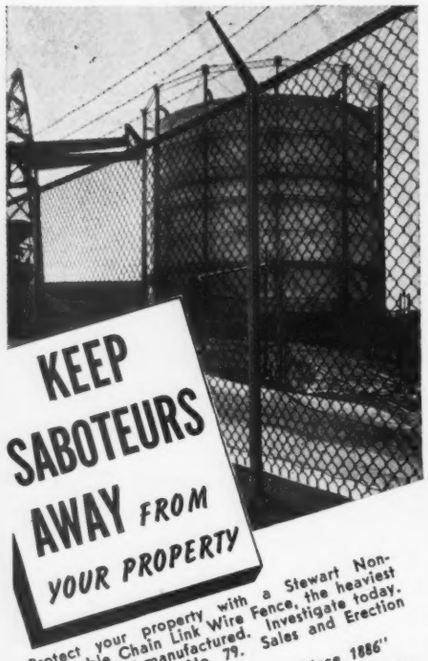


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ment departments, I do believe that the article which you published is entirely out of order.

W. A. PORTERFIELD, Vice-President
Union Metal Manufacturing Co.,
Canton, Ohio.

[We feel, as does our correspondent, that there are a lot of mighty fine, sincere men among the Army engineers and that in general their integrity has been beyond question. On the other hand, the last eight years have brought about instances where reversals of previous opinion based on the same engineering data have been difficult to explain or understand.

We see no reason, however, for unquestioning confidence. When a government department, for instance, says that a certain water-power project is to be started for national defense purposes, how can we have much confidence when the least time in which the power can be made available will be five years and the more probable time six or seven years?—EDITOR.]

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## G.E. Forms Distributing Branch in New York

In order to handle more adequately the special distribution problems which are peculiar to certain products in the Metropolitan New York area, the General Electric Co. has established a new metropolitan distributing branch, with headquarters in the General Electric Building, 570 Lexington Avenue, New York City.

The new branch will distribute at wholesale products of the company's air conditioning and commercial refrigeration department of Bloomfield, N. J., and products of the radio and television and of the appliance and merchandise departments of Bridgeport, Conn.

Earle Poorman, who has been district manager of appliance sales in New York since 1931, has been appointed manager of the metropolitan distributing branch. He will continue as district appliance sales manager, in addition to his new responsibilities.

•

## Gets Steel Tower Award

Bethlehem Steel Co., Bethlehem, Pa., has received the contract from the Administrator, Bonneville Project, Department of Interior, Portland, Ore., at $299,668 for 300 steel towers for new transmission line from Bonneville power station to Oregon City, Ore., about 51 miles, designed to carry a maximum of 115,000 volts.

## Johns-Manville Sets Up New District

A new industrial department office has been established by Johns-Manville to facilitate service to the South's rapidly growing industry, Lewis H. Brown, president, has announced. The new district, with headquarters at Atlanta, Ga., will serve the states of Georgia, Tennessee, North Carolina, South Carolina, Florida, Alabama and Mississippi. The new district is headed by Thomas J. Roberts, formerly assistant to T. K. Mial, vice-president in charge of sales to industry and product development for general industrial use, with headquarters at New York.

Hygrade Sylvania Corp. has appointed Robert W. Bishop supervisor of sales for the New England district, which has been extended to include the territory from Erie, Pa., and Buffalo, N. Y., eastward. Mr. Bishop was formerly in charge of eastern sales for the company.

Mitchell Manufacturing Co., Chicago, has appointed Jack Neuhauser sales representative in Illinois and southern Wisconsin. Mr. Neuhauser is well known in the lighting industry, having been affiliated with the Commonwealth Edison Co. for the past ten years, serving orignally as an illuminating engineer, later as designer of special lighting equipment and in recent years as lighting engineer and salesman in the downtown Chicago area.

•

## Sales of Electrical Goods Show 40% Gain in Month

Sales of wholesalers of electrical goods of 326 reporting firms totaled $23,256,000 in January, a gain of 40 per cent over a year ago but 24 per cent less than December, 1940, according to the Department of Commerce. Inventories of 280 reporting firms totaled $24,904,000 at the end of January, a gain of 23 per cent over a year ago and a gain of 16 per cent over December, 1940.

As of January 1, 1940, accounts receivable of 307 reporting firms totaled $34,857,000, a gain of 24 per cent over a year ago and again of 14 per cent over December, 1940.

•

## Crane Priorities

To speed work in shipyards working on naval craft and other vital defense plants, nine builders of electric traveling cranes have been granted a general preference order by the priorities division of the Office of Production Management. The order will help the crane builders to obtain prompt delivery of motors, switches, controllers, connections, finished or semi-finished parts and accessories, and steel bar, plate, shapes, forgings and castings.


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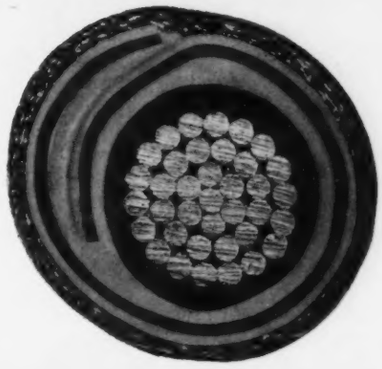

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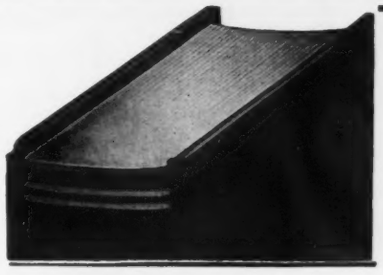

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## Infra-Red Studies Develop New Guides

[*Continued from page 71*]

It is often important in the baking of enamels and lacquers that sufficient time should elapse before the actual baking takes place, to allow the solvents or volatiles to evaporate, otherwise pinholes or pits occur in the finish. The preliminary drying resolves itself into a few lamps mounted in an area intervening between the spray booth and the tunnel.

Another necessary precaution is to avoid extreme variations in the intensity in the field through which the material must travel. Hot spots that result from varying intensities tend to overbake some portions and underbake others.

Overbaked portions may discolor under this treatment. To secure uniformity of field it sometimes is desirable to stagger the reflectors with reference to the axis of the conveyor. In other cases it is necessary to combine rotary and straight line motion. Turntables are sometimes placed on the conveyor to do this, it was stated.

### *Radiant Drying Tunnels*

A radiant drying tunnel developed by the commission investigating agency* is shown in the accompanying illustration. It consists essentially of assemblies of a four-light bar. In the tunnel shown there are eight four-light bars using 8¼ in. diameter reflectors with a minimum spacing of 8¼ in. center to center of filament. The reflectors can be either staggered or opposite with reference to each other and in the case of successive rows. The staggered arrangement permits of greater and more uniform concentration of energy on the work to the extent of about 15 per cent. Energy concentration corresponding to various lamp spacings and heights of work are given in the accompanying table.

Features of the tunnel† may be summarized briefly as follows:

1. Reflectors are rigidly locked together.
2. The four-light bars can be assembled in parallel, tandem or in other arrangements and individually are highly portable.
3. Diameter of individual reflector is considered to be more favorable than reflectors that are either larger or smaller.
4. Reflector and bar assembly is low priced.
5. Reflectors are easily cleaned.
6. Over-all dimensions are a minimum and this is desirable where space is limited, as often occurs.

* Testing department, Commonwealth Edison Company, Chicago.

† See "Electrical World," March 23, 1940, pages 76-78, for details.

## Economical Answers to Voltage Regulation

[*Continued from page 60*]

in combination with step-voltage boosters. A number of such installations have been made with uniformly successful results.

A typical installation was made in 1939 on a small distribution system consisting of 9.5 miles of No. 4, two-phase, 4-kv. wye and 8.5 miles of No. 6, single-phase line as shown in an accompanying illustration. This 18 miles of line had been in operation for some ten years, supplying energy to a typical rural area, and in that time had given excellent service. During 1938 a number of heavy-duty appliances were installed, and due probably to a good orange crop and the resulting prosperity the load on the longer phase reached the unusual peak of 30 kw.

Under these conditions the primary voltage at the end of the line dropped to 97 volts at the time of the evening peak, resulting in a primary regulation of approximately 23 per cent and a secondary regulation of approximately 26 per cent. Load and voltage data were obtained immediately. This condition was recognized and the necessary corrective steps determined.

### *Alternative Corrective Schemes*

Three schemes were considered for improving the voltage on this line, any one of which would have resulted in satisfactory voltage, but which varied widely in cost. These schemes were:

1. Convert the present two-phase, 4-kv. wye system to three-phase and extend three-phase over the entire 18 miles of the lateral which was in voltage difficulty at an estimated cost of $10,000.

2. Convert a section of the system including the 18-mile lateral to 13.2 kv. at an estimated cost of $7,500.

3. Install a combination of step-voltage regulators and capacitors at an estimated cost of $2,000.

Each scheme was investigated and it was found that under schemes 1

and 2 it would be necessary to expend considerable sums on the system as well as on the lateral on which it was desired to improve conditions. Under scheme 3 only was it possible to correct the voltage on the one lateral without in any way changing the remainder of the system.

Scheme 3 was adopted and the decision was to install three step-voltage regulators and two 15-kva. capacitors. Two step-voltage regulators were installed on the two-phase section of line approximately 4.5 miles from the substation, while the third regulator was installed on the single-phase section of line approximately 12 miles from the substation. The two 15-kva., single-phase capacitors were installed on the single-phase section of line, one 8 miles and the other 18 miles from the substation.

The calculated and experienced gains from the installation of a combination of capacitors and step regulators are shown in accompanying illustrations.

In this article two regulation problems and their solution in terms of a synchronous condenser, capacitors and step-voltage boosters have been discussed. A subsequent article will describe in detail a method of overcompensating induction and step-voltage regulators which has resulted in improved secondary regulation. It has also in effect increased the load-carrying capacity of all regulated feeders on the system.

•

## Receive Coffin Awards

The Charles A. Coffin Foundation awards have been made to 25 employees of General Electric Co., recognizing them for outstanding contributions made last year to the progress of the company and the electrical arts. Since the Foundation was established, eighteen years ago, 555 employees have been singled out to receive annual awards. Outstanding was the development and design of a 1,400,000-volt direct-current generator for the National Bureau of Standards by Horace S. Hubbard.

•

## Plans Large Addition

Allis-Chalmers Manufacturing Co., Milwaukee, has awarded a general contract to Permanent Construction Co., also of Milwaukee, for a one-story addition, 200x230 ft., to plant at West Allis, to be equipped as a plate and tank shop.


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NEW YORK STATE ELECTRIC & GAS CORP'S large power users in the Oneonta district will save approximately $23,000 per annum under a new rate which the Public Service Commission permitted the company to put into effect on March 26. This reduction is part of the general reduction of $1,200,000 which the company will file for its entire territory under permission granted by the commission several weeks ago. In that general reduction, approximately $121,000 were for large power users. The $23,000 reduction is the Oneonta district share of the downward revision in the power rate contemplated in the general reduction. In addition to the power rate revision, the Oneonta district share for residential and commercial service in the $1,200,000 reduction is $182,000. Filing by the company of the general revision for the entire territory is expected in the near future.

ELKHORN LIGHT AND WATER COMMISSION, Elkhorn, Wis., has announced a 12½ per cent reduction in city electrical rates effective with the March billing. The announcement stated that the reduction is possible because of the continued and increased use of electricity and a new wholesale rate with the Wisconsin Gas & Electric Co. The total annual reduction is estimated at $9,200 and applies to residential, water heating, power, commercial and street lighting use.

•

## Municipal Plants

FLORA, IND.—State Supreme Court has reversed a decision by a judge at Delphi, Ind., in the condemnation proceedings of this town against the Indiana Service Corp. The original suit was brought to force sale to the town of the privately-owned utility. The court last June found for the town and appointed appraisers. The utility appealed on the ground that the condemnation of the plant was void because the town offered to purchase all property of the utility and then sought to condemn only part of it.

CRISFIELD, MD.—The town has asked the Maryland General Assembly to pass a bill authorizing the municipality to construct and operate its own electric light and power plant. The bill also provides for a bond issue of $500,000 to pay for the project. The Mayor and city council are backing the plan. Eastern Shore Public Service Co. now serves the city.


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